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Improving quality of care: a continuous process of (de-)implementation

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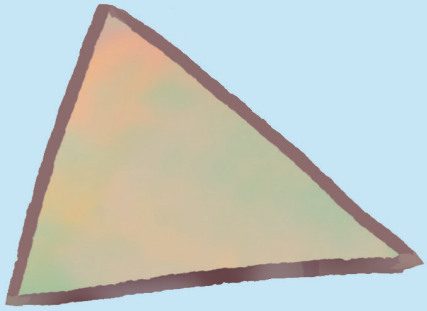
Citation
Rietbergen, T. (2024, June 26). *Improving quality of care: a continuous process of (de-)implementation*. Retrieved from https://hdl.handle.net/1887/3765462

Version:	Publisher's Version
License:	Licence agreement concerning inclusion of doctoral thesis in the Institutional Repository of the University of Leiden
Downloaded from:	https://hdl.handle.net/1887/3765462

Note: To cite this publication please use the final published version (if applicable).



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Implementation strategies used to implement nursing guidelines in daily practice: A Systematic Review

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International journal of nursing studies (2020)

ABSTRACT

Objectives

Research specifically addressing implementation strategies regarding nursing guidelines is limited. The objective of this review was to provide an overview of strategies used to implement nursing guidelines in all nursing fields, as well as the effects of these strategies on patient-related nursing outcomes and guideline adherence. Ideally, the findings would help guideline developers, healthcare professionals and organizations to implement nursing guidelines in practice.

Design

Systematic review. PROSPERO registration number: CRD42018104615.

Data sources

We searched the Embase, Medline, PsycINFO, Web of Science, Cochrane, CINAHL and Google Scholar databases until August 2019 as well as the reference lists of relevant articles.

Review methods

Studies were included that described quantitative data on the effect of implementation strategies and implementation outcomes of any type of a nursing guideline in any setting. No language or date of publication restriction was used. The Cochrane Effective Practice and Organisation of Care taxonomy was used to categorize the implementation strategies. Studies were classified as effective if a significant change in either patient-related nursing outcomes or guideline adherence was described. Strength of the evidence was evaluated using the 'Cochrane risk of bias tool' for controlled studies, and the 'Newcastle-Ottawa Quality Assessment form' for cohort studies.

Results

A total of 54 articles regarding 53 different guideline implementation studies were included. Fifteen were (cluster) Randomized Controlled Trials or controlled before-after studies and 38 studies had a before-after design. The topics of the implemented guidelines were diverse, mostly concerning skin care (*n*=9) and infection prevention (*n*=7). Studies were predominantly performed in hospitals (*n*=34) and nursing homes (*n*=11). Thirty studies showed a positive significant effect in either patient-related nursing outcomes or guideline adherence (68%, *n*=36). The median number of implementation strategies used was 6 (IQR

4-8) per study. Educational strategies were used in nearly all studies (98.1%, *n*=52), followed by deployment of local opinion leaders (54.7%, *n*=29) and audit and feedback (41.5%, *n*=22). Twenty-three (43.4%) studies performed a barrier assessment, nineteen used tailored strategies.

Conclusions

A wide variety of implementation strategies are used to implement nursing guidelines. Not one single strategy, or combination of strategies, can be linked directly to successful implementation of nursing guidelines. Overall, thirty-six studies (68%) reported a positive significant effect of the implementation of guidelines on patient-related nursing outcomes or guideline adherence. Future studies should use a standardized reporting checklist to ensure a detailed description of the used implementation strategies to increase reproducibility and understanding of outcomes.

INTRODUCTION

Nurses are increasingly expected to provide evidence-based care intended to enhance quality of care[1]. Therefore, an increasing number of nursing guidelines are being published. A guideline in general contains evidence-based recommendations for healthcare providers, policy makers, and patients about health interventions intended to optimize patient care. Guidelines are published with the aim of reducing unwarranted variation in healthcare delivery[2-4]. Still, healthcare providers' adherence to guideline recommendations has proven suboptimal[5-8]. Publishing or disseminating a guideline alone will not ensure adequate use of a guideline in practice. An essential second step is to apply strategies to effectively implement the guideline[9]. Using a theory, model or framework, is expected to increase the probability of success of the implementation[10]. This also holds for performing a barrier assessment and tailoring strategies[11], which are often elements in theories, models or frameworks.

As nursing and medical care, as well as the associated guidelines, differ in nature, other strategies may be needed to anchor nursing guidelines in practice. Previous reviews about nursing guideline implementation considered studies addressing a single implementation strategy, such as education[12] or facilitation[13], or a specific setting, such as nursing homes[14]. More and more implementation studies in the field of nursing are being conducted[15]. However, to the best of our knowledge, the implementation strategies of nursing guidelines, independent of type or setting, have not been systematically reviewed to this date. A systematic review could provide insights useful in all areas of nursing.

The objective of this review was to provide an overview of strategies used to implement nursing guidelines in all nursing fields, as well as the effects of these strategies on patient-related nursing outcomes and guideline adherence. Ideally, the findings would help guideline developers, healthcare professionals and organizations in implementing nursing guidelines in practice.

METHODS

Design

This systematic review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines[16]; the research protocol was registered on PROSPERO (registration number: CRD42018104615).

Search

Relevant studies were searched in the Embase, Medline, PsycINFO, Web of Science, Cochrane, CINAHL and Google Scholar databases until August 2019. Various search terms were purposefully selected to cover all nursing fields and implementation synonyms. A biomedical information specialist of the medical library of the Erasmus MC – University Medical Centre Rotterdam guided the search. The full search strategy is presented in *Supplement 1. Search strategy*. The titles and abstracts of all search results were screened on relevance by DS and EI independently, according to specified eligibility criteria, using Endnote®[17]. Next, the full texts of possibly relevant articles were checked for inclusion by DS. Consensus on final inclusion was achieved by discussion (DS, EI). After the initial search, a reference and citation check were performed for all relevant studies (by DS, EI). To ensure having a complete overview of all published studies, several previously published systematic reviews were screened for relevant included studies[12-14,18].

Eligibility criteria

The scope of the review was limited to studies that considered the implementation of a nursing guideline, defined as recommendations about health interventions mainly provided by nurses (>50%), intended to optimize patient care and based on either national or international guidelines. The following inclusion criteria were applied: 1) studies had to describe the implementation strategies and outcomes of the implementation of the nursing guideline; 2) studies had to measure either the effects of the implemented nursing guideline on patient-related nursing outcomes (e.g. pain, falls, pressure ulcers), or adherence to the guideline by the healthcare professionals measured by observation or documentation; 3) studies had to include a reference group (e.g., with and without guideline). Case studies of individual patients, letters and editorials were not eligible. To optimize the objectivity of the included study results, we excluded studies with only survey outcomes. We excluded bundle implementation studies because of their protocol-like characteristics. No search limitations were imposed on language.

Outcome measures

The primary outcomes were; 1) impact on patient-related nursing outcomes, and 2) adherence to the guideline. Studies were classified with a positive effect when a statistically significant improvement in patient-related nursing outcomes and/or adherence was reported.

The secondary outcomes were the number and types of implementation strategies per study. The different strategies used were categorized according

to the Cochrane Effective Practice and Organisation of Care taxonomy[19]. The Effective Practice and Organisation of Care taxonomy includes four domains of interventions: Implementation strategies, Delivery arrangements, Financial arrangements and Governance arrangements.

Data extraction

Relevant information from the included articles was extracted in a data abstraction form. This form was piloted for the first five studies and finalized after discussion (DS, TR, EI). Data included country of origin, setting, type of guideline, participants, implementation strategies, barrier assessment, use of implementation theory or framework, and outcomes. Depending on the measurements performed in the included studies, both or either of the primary outcomes (i.e. patient-related nursing outcomes or adherence to the guideline) were collected. All data abstraction forms were initially completed by DS and checked by either TR or EI. Differences were discussed when necessary.

Risk of bias assessment

The risk of bias of the included studies was assessed with two tools. The Cochrane risk of bias tool was used for the controlled studies[20]. This tool consists of nine items, of which each is scored high, low or unclear risk of bias. The 'Newcastle-Ottawa Quality Assessment form for Cohort studies' was used for cohort before-after studies[21]. The Newcastle-Ottawa Quality Assessment consists of three parts; selection, comparison and outcome. For each part a number of stars can be assigned, resulting in an overall score (good, fair or poor). Both risk of bias tools were included in the data abstraction form, initially completed by DS and checked by either TR or EI. Discrepancies were resolved by discussion.

The Newcastle-Ottawa Quality Assessment form for Cohort Studies contains a question on whether the follow-up was long enough for the outcome to appear[21]. In line with recommendations of the World Health Organisation (WHO) on implementation research, we took it that a period of at least of 3 months, for baseline and after measurement each, was sufficient[22]. After discussion DS, TR, and EI jointly decided that a three-month period was sufficient. Regarding the before-after studies, a follow-up period less than three months therefore resulted in poor scores on the outcome part of the Newcastle-Ottawa Quality Assessment form for Cohort Studies. The Cochrane tool does not contain such a parameter.

Analysis and synthesis

Meta-analysis was precluded due to heterogeneity across studies. This heterogeneity concerned differences in guidelines, implementation strategies, outcome measures, timing of follow-up measurements, and the level of detail of the used strategies. Instead we provided a descriptive and narrative synthesis of the primary outcomes guideline adherence and patient-related nursing outcomes of the individual implementation studies. We provided a summary table with all crucial elements of the implementation processes (duration, used implementation strategies, barrier assessment, use of implementation framework, used implementation outcomes *Supplement 2*. The number of implementation strategies were categorized into the four EPOC categories (Delivery, Financial, Government and Implementation strategies). The total number of implementation strategies that were used in the implementation studies were summarized as median with IQR. The median number of used implementation strategies was provided for all studies, per EPOC category (Delivery, Financial, Government and Implementation strategies), for the studies that presented a positive significant change on one or more of their primary outcomes, and for the studies who reported no significant change.

Further, the relative change percentage was calculated for the studies providing patient-related nursing outcomes. Calculating a relative change of guideline adherence before the (re)implementation of a guideline is expected to be of low value, because the adherence rate to a not yet implemented guideline will always be low at baseline. Moreover, not all studies measured adherence at baseline. Therefore, we chose not to calculate the relative change of our other primary outcome 'adherence'. For the before-after studies, the relative change was computed by dividing the absolute outcome by the baseline level, preferably for the primary outcome of that individual study. However, in some studies the patient-related nursing outcome was a secondary outcome. For controlled studies, we first computed the relative change separately for the intervention group and the control group. Subsequently, the calculated relative change percentage in the intervention group was divided by the calculated relative change in the control group[23]. *Supplement 3. Calculations of relative change percentage for the patient-related nursing outcomes* provide an example of how the relative changes were calculated for both study groups. Of note is that the relative change for the before-after studies could have been overestimated due to the lack of a control group.

The association between the relative change and the total number of EPOC strategies used in the included studies was visualized in a scatterplot, for the controlled studies and the before-after studies separately. The difference

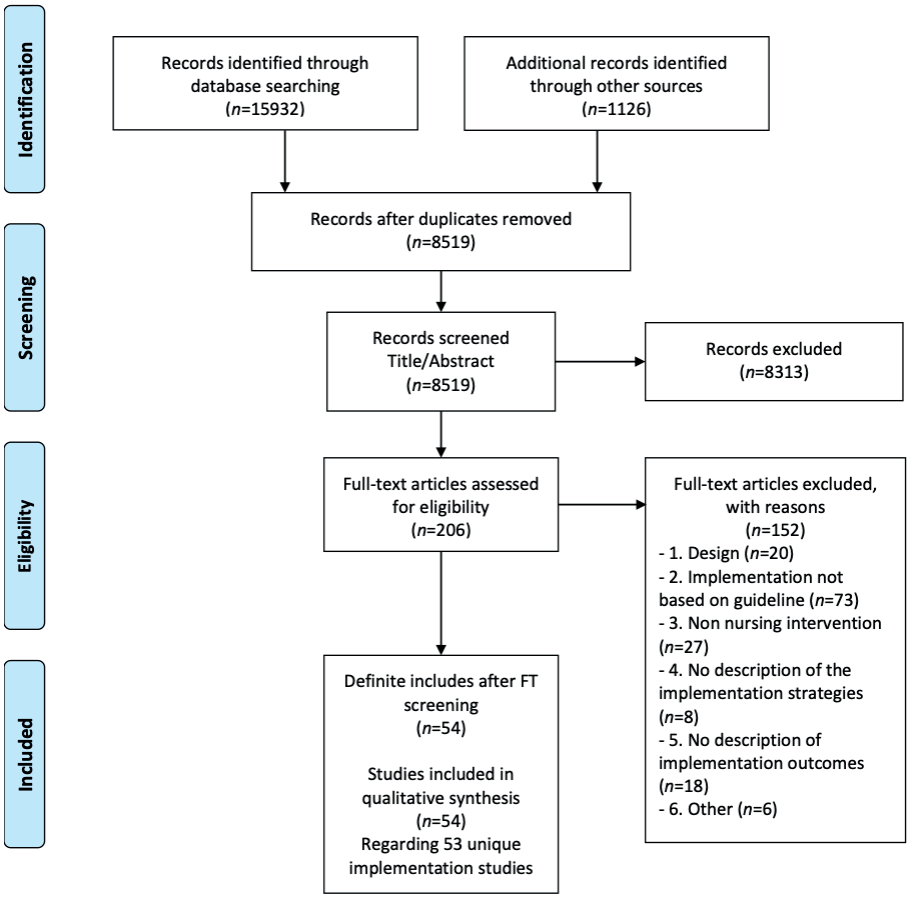
between the median relative change for studies using only strategies from the EPOC category Implementation strategies or using a combination of strategies from different EPOC categories was assessed using the Mann-Whitney U test. For comparable groups of similar guidelines with similar outcomes (at least 3 studies), the median relative change was assessed and related to the use of EPOC category implementation strategies alone or to the use of a combination of strategies from different EPOC categories.

RESULTS

Study selection

The initial search strategy and the cross-reference check yielded a total of 17,058 records. After 8539 duplicates were removed, 8519 abstracts were assessed for eligibility. Two-hundred-and-five full-text records remained and were assessed for eligibility, after which eventually 54 records, regarding 53 unique studies, were included for the synthesis' *(Figure 1 Flow diagram for identification, screening and eligibility according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses protocol).*

Figure 1. Flow diagram for identification, screening and eligibility according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses protocol[16].



Study characteristics

Study design, setting and guideline topic

The 54 papers described 53 unique implementation studies on 21 guideline topics. Fifteen had a controlled before-after, randomized controlled trial or cluster randomized controlled trial design; 38 studies (71.7%) had a before-after design. Most studies were conducted in western countries (USA *n*=10, Netherlands *n*=9, Australia *n*=8). Half of the studies were performed in a single centre (*n*=27, 50.9%). Most of the guidelines regarded skin care (*n*=9) and infection prevention (*n*=7). Two studies addressed the implementation of a combination of several guidelines, respectively six[24] and three[25,26]. The most studied setting was a hospital (*n*=34, 64.2%), followed by a nursing home (*n*=11), general practice (*n*=5), home care (*n*=2), and inpatient rehabilitation centre (*n*=1). *Table 1. Study characteristics broken down by guideline topic* shows the study characteristics of the included studies, *Supplement 2. Description of included studies* provides a more detailed description of the included studies.

Table 1. Study characteristics broken down by guideline topic

Author, Year	Country	Design	Setting, Single/Multi centre	Guideline topic
Van den Boogaard, 2009[27]	Netherlands	Before-After	Hospital - Intensive Care Unit (PICU and Intensive Care Unit) in a tertiary hospital, Single centre	Agitation - Delirium
Trogrlic, 2019[28]	Netherlands	Before-After	Hospital - Intensive Care Units in 1University Medical Centre and five community hospitals, Multi centre	Agitation - Delirium
Pun, 2005[29]	USA	Before-After	Hospital - Intensive Care Unit wards of the Van der Bilt University Medical Centre in Nashville and the Veterans Administration Tennessee Valley Healthcare System-York Campus, Multi centre	Agitation - Delirium and sedation
Edwards, 2007[24]	Canada	Before-After	Hospital and nursing homes - 7 hospitals + 2 home visiting nursing service organisations and one public health unit, Multi centre	Combination of multiple guidelines - Asthma, breastfeeding, delirium-dementia-depression, smoking cessation, venous leg ulcers, diabetes
Van Gaal (a,b), 2011[25,26]	Netherlands	Cluster Randomized Controlled Trial	Hospital and nursing homes - 1 university hospital. 2 large teaching hospitals, one small hospital and 6 nursing homes. 10 hospital wards + 10 Nursing home wards, Multi centre	Combination of multiple guidelines - Pressure ulcer, urinary tract infection and falls
Seto, 1991[30]	China	Before-After	Hospital - 6 wards, 3 male, 3 female, Single centre	Infection prevention - Catheter associated urinary tract infections
Huis, 2013[31]	Netherlands	Cluster Randomized Controlled Trial	Hospital - 3 hospitals in the Netherlands, Multi centre	Infection prevention - hand hygiene
Rao, 2009[32]	United Kingdom	Cluster Randomized Controlled Trial	Nursing home - 12 nursing homes in and surrounding south London, Multi centre	Infection prevention - Hand hygiene, environmental and disposal hygiene.

Author, Year	Country	Design	Setting, Single/Multi centre	Guideline topic
Zhu, 2018[33]	China	Before-After	Hospital - Shanghai Public Health Clinical Centre, Single centre	Infection prevention - Non-pharmacological fever management in HIV patients
Cabilan, 2014[34]	Australia	Before-After	Hospital, Single centre	Infection prevention - Peripheral cannula infections
Frigerio, 2012[35]	Italy	Before-After	Hospital - 6 Orthopaedic Surgery, 2 Traumatology, 1 Neurosurgery, 1 Neurology, 1 General Surgery, 2 General Medicine, Single centre	Infection prevention - Peripheral venous catheter management
Gomarverdi, 2019[36]	Iran	Cluster Randomized Controlled Trial	Hospital -Intensive Care Unit wards in two different hospitals, Multi centre	Infection prevention - Standard precautions in Intensive Care Units
Abraham , 2019[37]	Germany	Cluster Randomized Controlled Trial	Nursing home - 120 nursing homes, Multi centre	Mobility - physical restraint use
Ward, 2010[38]	Australia	Cluster Randomized Controlled Trial	Nursing home - residential aged care facilities with at least 20 beds, 88 facilities included, Multi centre	Mobility - Preventing falls
Köpke, 2012[39]	Germany	Cluster Randomized Controlled Trial	Nursing homes, 36 in total, Multi centre	Mobility - Use of physical restraints
Lockwood, 2018[40]	Australia	Before-After	Hospital - Two private hospitals in a regional area, Multi centre	Mobility - Venous - thromboembolism prevention programme
Törmä, 2014[41]	Sweden	Controlled Before-After	Nursing homes - 4, Multi centre	Nutritional

Author, Year	Country	Design	Setting, Single/Multi centre	Guideline topic
Cahill, 2014[42]	Canada / USA	Before-After	Hospital - 5 participating Intensive Care Unit's (one divided in 3 units) in Canada and the USA. In non- and teaching hospitals, Multi centre	Nutritional - Enteral nutrition in the Intensive Care Unit
Johnson, 2017[43]	United Kingdom	Before-After	Hospital - tertiary neonatal intensive care unit, Single centre	Nutritional - improve nutrition and growth of preterm infants in neonatal intensive care.
Giugliani, 2010[44]	Angola	Before-After	Hospital - Therapeutic feeding centre, consists of a separate ward for severely malnourished children only, Single centre	Nutritional - Malnutrition care in rural Africa
Lopez, 2004[45]	China	Before-After	Hospital - Tertiary care teaching hospital, Single centre	Nutritional - nutrition support in mechanically ventilated, critically ill adult patients.
Ames, 2011[46]	USA	Before-After	Hospital - 4 different critical care units, Multi centre	Oral Care - Prevention of VAP
De Visschere, 2012[47]	Belgium	Cluster Randomized Controlled Trial	Nursing homes - In Flanders Belgium, Multi centre	Oral care
Van der Putten, 2013[48]	Netherlands	Cluster Randomized Controlled Trial	Nursing homes - Within 100km radius of the centre of the Netherlands, Multi centre	Oral care
Lozano, 2004[49]	USA	Cluster Randomized Controlled Trial	Primary care paediatric practices, Multi centre	Other - Asthma treatment
Clark, 2001[50]	United Kingdom	Before-After	Hospital - a large teaching hospital, Single centre	Other - Blood transfusion
Tian, 2017[51]	Belgium	Before-After	Hospital, Single centre	Other - Cancer related fatigue

Author, Year	Country	Design	Setting, Single/Multi centre	Guideline topic
Van Lieshout, 2016[52]	Netherlands	Cluster Randomized Controlled Trial	General Practices, Multi centre	Other - Cardiovascular risk management in general practices
Downey, 2015[53]	Australia	Before-After	Hospital - A 18 bed Head, neck and lung medical oncology ward, Single centre	Other - Crushing medication in case of Tube feeding only
Sipila, 2008[54]	Finland	Before-After	General practices - 31 in total, Multi centre	Other - Early detection, prevention and treatment of CVD (Cardiovascular disease)
Snelgrove-Clarke, 2015[55]	Canada	RCT	Hospital - University affiliated teaching hospital in Atlantic, Single centre	Other - Foetal Health Surveillance
Featherston, 2018[56]	USA	Before-After	Community mental health centre, Single centre	Other - Paediatric mental healthcare
Jagt-van Kampen, 2015[57]	Netherlands	Before-After	Hospital - Academic children's hospital, Single centre	Other - Paediatric palliative care
Duff, 2013[58]	Australia	Before-After	Hospital - a 250-bed magnet designated private hospital, Single centre	Other - Prevention of venous thromboembolism
Vander Weg, 2017[59]	USA	Before-After	Hospital - General medical units of four US Department of Veterans Affairs hospitals, Multi centre	Other - Smoking cessation
Reynolds, 2016[60]	USA	Before-After	Hospital - Neuro critical care unit, Single centre	Other - Stroke care
Cheater, 2006[61]	United Kingdom	Cluster Randomized Controlled Trial	Family practice, Multi centre	Other - Urinary incontinence
Savvas, 2014[62]	Australia	Before-After	Nursing home - Residential aged care facilities across three Australian states, Multi centre	Pain - Australian Pain Society

Author, Year	Country	Design	Setting, Single/Multi centre	Guideline topic
Dulko, 2010[63]	USA	Before-After	Hospital, Single centre	Pain - Cancer related
Choi, 2014[64]	South-Korea	Before-After	Hospital - A university affiliated tertiary hospital, Single centre	Pain - Cancer related
Kingsnorth, 2015[65]	Canada	Before-After	Hospital - a large academic paediatric rehabilitation hospital, Single centre	Pain - Paediatric pain
Habich, 2012[66]	USA	Before-After	Hospital - Paediatric Intensive Care Unit at a community hospital located in a suburb of Chicago, IL, Single centre	Pain - Paediatric pain assessment and management guidelines
Bale, 2004[67]	USA	Before-After	Nursing homes - 6, Multi centre	Skin care
Harrison, 2005[68]	Canada	Before-After	Home care - The Ottawa Community Care Access Centre, an eastern Ontario home care-authority, Multi centre	Skin care - Leg ulcers
De Laat, 2006[69]	Netherlands	Before-After	University hospital, Single centre	Skin care - pressure ulcer
Paquay, 2010[70]	Belgium	Before-After	Home care - 5 participating home nursing agencies, Multi centre	Skin care - pressure ulcer
De Laat, 2007[71]	Netherlands	Before-After	Hospital - Critical care unit in an academic hospital, Single centre	Skin care - pressure ulcer
Beeckman, 2013[72]	Belgium	Cluster Randomized Controlled Trial	Nursing home - 11 wards, Multi centre	Skin care - pressure ulcer care
Koh, 2018[73]	Singapore	Before-After	Hospital - Two orthopaedic wards, Single centre	Skin care - pressure ulcer prevention
Rosen, 2006[74]	USA	Before-After	Nursing home, Single centre	Skin care - pressure ulcer prevention
Lopez, 2011[75]	Australia	Before-After	Hospital - Australian Capital Territory hospitals, Single centre	Skin care - Skin tears
Jolliffe, 2019 [76]	Australia	Before-After	Other - Inpatient Rehabilitation setting, Single centre	Stroke care
Bjartmarz, 2017[77]	Iceland	Before-After	Hospital - Neurology and rehabilitation ward in university hospital, Single centre	Stroke care

Participants

Twenty-seven studies provided no description of the targeted professionals other than 'nurses'. In some studies, nurse aids, student nurses or nurse practitioners were (part of) the target group, few studies targeted multiple professionals (physicians, physical therapists, etc.). The median number of involved caregivers per study (*n*=27) was 118 (IQR 34-238); twenty-six studies did not provide the number of involved caregivers.

Sixteen studies did not describe any details of the targeted patients; the other studies described basic characteristics regarding age and gender. Several studies described baseline characteristics related to the guideline of interest. Regarding 35 of all included studies, the median sample size of included patients was 373 (IQR 140-1577); seventeen studies did not report the sample size. Also shown in *Supplement 2.*

Risk of bias assessment

Nine controlled studies scored low risk of bias on most items (seven or more out of the nine items), as shown in *Supplement 4. Cochrane risk of bias for controlled studies.* The remaining six studies scored unclear or high risk of bias on three or more out of nine items. Thirty-two of the 38 before-after studies scored poor, assessed with the Newcastle-Ottawa Quality Assessment form for Cohort Studies (*Supplement 5*). Thirty of these 32 studies scored poor on the comparability part. These studies did not control for age, sex, or other factors, or did not correct for confounding when comparing the before and after groups. Four before-after studies were assessed as good; two as fair.

Implementation outcomes

All studies used a variety of implementation strategies, which were rarely comparable and with variable outcomes. The duration of the measurements, the intensity and the degree of details of the used strategies varied across studies. Twenty-one studies measured both patient-related nursing outcomes and guideline adherence. Eleven of these studies found a significant improvement on both outcomes. Overall, thirty-six studies (68%) measured a significant positive change on either patient-related nursing outcome measure(s) or guideline adherence.

Patient-related nursing outcomes

Patient-related nursing outcomes were measured in 30 studies. Twenty-one (70%) measured a significant positive change, seven measured no change,

and two studies did not perform statistical tests. All studies reported findings indicating a positive change or no change. However, one study[41] reported a significant negative effect on one of the patient-related nursing outcome measures that were addressed. Törmä et al.[41] compared two implementation strategies (external facilitation and education outreach visits) in order to introduce nutritional guidelines. Besides no differences in nutritional parameters after 18 months, they found significant deteriorations for functional and cognitive status, as well as for the EQ-5D index (quality of life questionnaire), (p<0.05) in the intervention group that received educational outreach visits.

Ten of the controlled studies (n=15) measured patient-related nursing outcomes. Six found a significant positive effect; four found no effect. Twenty-two of the before-after studies (n=37) measured patient-related nursing outcomes. Thirteen found a significant positive effect, seven found no significant effect (n=7), and two performed no statistical tests (n=2). When comparing the controlled and before-after studies, we found no significant difference between these groups on reported significant change in patient-related nursing outcomes (p≥0.05).

Relative change percentage on the patient-related nursing outcomes

All relative changes are shown in *Supplement 6 and Supplement 7*. The median relative change measuring patient-related nursing outcomes was 2.7% (IQR 1.0-40.6) for the controlled studies (n=10), and 22.1% (IQR 8.7-81.4) for the before-after studies (n=19). This differed significantly between the controlled and before-after groups (p=0.009).

The scatterplots for the controlled (*Figure 2*) and before-after (*Figure 3*) studies show that there was no association between the total number of used strategies and the relative change on the patient-related nursing outcomes. For the controlled studies the slope suggests that using more strategies, will result in a lower relative change. However, the sample is too small to conclude this (n=10).

The median relative change for studies that used strategies from the EPOC category implementation strategies alone was 13.8% (IQR 3.6-81.9). For the studies that used a combination of strategies from the EPOC categories the median was 20.1% (IQR 3.2-67.3), however this was not statistically different (p=0.95).

Figure 2. Scatterplot relating the total number of EPOC implementation strategies used to the relative change percentage in patient-related nursing outcomes for the controlled studies

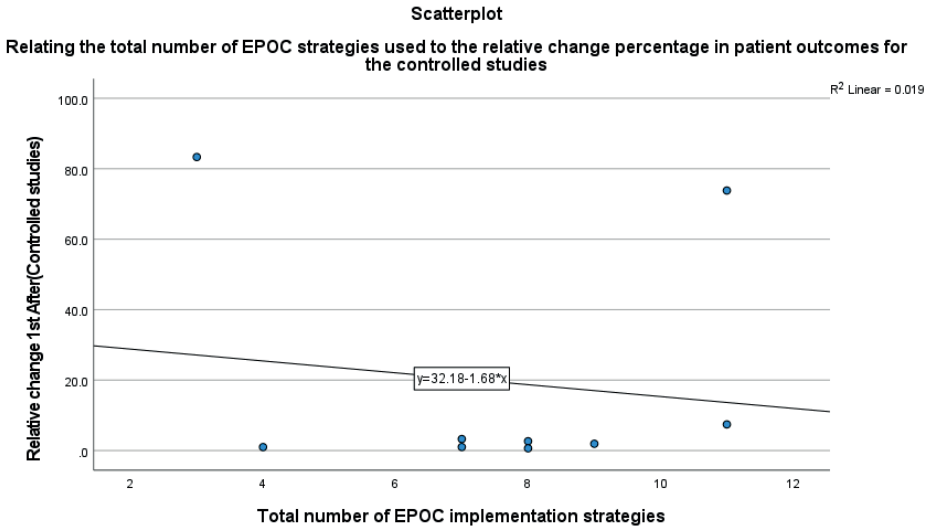
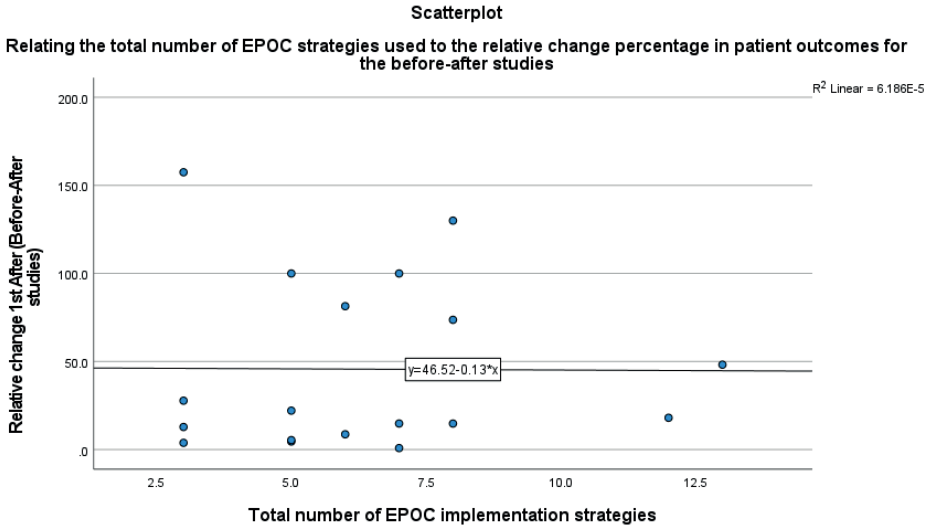


Figure 3. Scatterplot relating the total number of EPOC implementation strategies used to the relative change percentage in patient-related nursing outcomes for the before-after studies



We created three groups of studies with comparable patient-related nursing outcomes regarding comparable nursing guidelines. One group consisted of five studies[69,71-74] regarding pressure ulcers. The median relative change percentage for these studies was 27.8 (IQR 11.1-58.3). The outcomes were comparable between these studies, but not exactly derived in the same way. For example, Koh et al.[73] reported that they measured the incidence of pressure ulcers on the heel only. The other four studies provided no details about the location of pressure ulcers. The second group consisted of four studies[41-44] regarding nutritional intake. The median relative change percentage for these studies was 3.3 (IQR 0.9-11.0). The third group consisted of three studies[46-48] regarding oral care, with a median relative change percentage of 3.3.

Guideline adherence

Guideline adherence was measured in 44 studies, of which 26 (59,1%) showed a significant improvement, fourteen measured no change, and four did not perform statistical tests. Due to the heterogeneity in measuring adherence across all studies, we cannot draw an overall conclusion on the change in adherence rates. For example, several studies measured adherence rates regarding pain management (assessment and/or treatment). Kingsnorth et al.[65] found a significant and clinically relevant improvement in the documentation of pain scores, from 9% adherence rate at baseline to 100% adherence rate two years later. Dulko et al.[63] showed an increase in adherence rate for initial comprehensive pain assessment from 1% to 43% (p = 0.008).

Twelve of the controlled studies (*n*=15) measured adherence. In six studies a significant positive effect on adherence was found (*n*=6); six found no effect (*n*=6). Thirty-two of the before-after studies (*n*=32) measured adherence. Twenty studies found a significant positive effect on adherence (*n*=20), eight found no effect (n=8), and four performed no statistical tests (*n*=4). When comparing the controlled and before-after studies, we found no significant difference between these groups on effect on adherence (Pearson Chi-Square 0.564, $p>0.05$).

Implementation strategies

Description of the details of the implementation strategies varied widely between studies. Some provided a detailed process description, others just mentioned the type of strategy (e.g., audit and feedback).

Table 2 provides an overview of applied strategies categorized according to the Cochrane Effective Practice and Organisation of Care taxonomy and *Supplement 2*. provides a detailed description of the implementation strategies. Each study used more than one strategy, with a median of 6 (IQR 4-8). Apart from one study[63], studies applied at least one educational strategy; e.g., educational material (*n*=38, 71.7%), meeting (*n*=43, 81.1%), outreach (*n*=10, 18.9%) or inter-professional education

(*n*=14,26.4%). Next to educational strategies, the use of local opinion leaders (*n*=29, 54.7%), and audit and feedback (*n*=22, 41.5%) were regularly applied. Only one study, Rosen et al.[74] described a governance arrangement, in this case; formal reprimands and subject to termination in case of failing to complete training.

For all studies, the median number of used strategies was 6 (IQR 4-8), with a median of 0 for the EPOC category delivery (IQR 0-1), and 0 for the EPOC category financial (IQR 0-0), and 0 for the EPOC category government arrangements (IQR 0-0), and a median of 6 (IQR 4-7) for the EPOC category implementation strategies. The median number of strategies in studies measuring patient-related nursing outcomes was 7.0 (IQR 5-8, *n*=21) for studies which reported a significant improvement, and was 6.0 (IQR 4.5-8.5, *n*=9) for studies which reported no change. The median number of strategies in studies measuring adherence was 6.0 (IQR 4.8-8, *n*=26) for studies that reported a significant improvement, and was 6.0 (IQR 4-7, *n*=18) for studies that reported no change.

Most studies did not apply strategies in the control group, or did not provide a description of usual care. Eight studies[37-40,48,49,61,72] applied strategies in the control group, in most cases printed study material or availability of products e.g. providing pH-strips.

Effects of implementation strategies

Fifteen cluster randomized controlled trials studied the effects of specific implementation strategies. The individual strategies and the combinations of strategies applied in these trials varied[25,26,31,32,36-39,41,47-49,52,55,61,72].

For example, two cluster randomized controlled trials, by De Visschere et al.[47], and van der Putten et al.[78], described a supervised implementation strategy for an oral hygiene guideline. Both found a decrease of denture plaque after a 6-month follow-up (respectively; $p<0.01$ and $p<0.0001$). Other randomized controlled trials did not use a supervised implementation strategy, which limited the ability to conclude effectiveness of this specific implementation strategy.

Lozano et al.[49] created three groups to implement an asthma treatment guideline. One group received a peer leader intervention, one received a planned care intervention, and one served as a control group, receiving care as usual. They only found an effect on patient-related nursing outcomes in the planned care intervention group; i.e., a decrease in asthma symptom days per year compared to usual care ($p=0.02$). We could not compare these outcomes with those of another cluster randomized controlled trial, because no similar implementation strategies were used in other randomized controlled trials.

Table 2. Applied strategies per study categorized with the Cochrane Effective Practice and Organisation of Care taxonomy, reported effect on adherence and patient related nursing outcomes.

Author	Year	Implementation strategies[1]																		Effect	
		Organisational Change	Audit and Feedback	Clinical incident reporting	Monitoring	Communities of practice	Educational materials	Educational meetings	Educational outreach	Inter-professional Education	Local Consensus Process	Local Opinion leaders	Managerial supervision	Patient mediated intervention	Reminders	Routine PROMS	Tailored	Delivery Arrangements	Financial Arrangements	Governance Arrangements	Total number of EPOC implementation strategies	Adherence	Patient-related nursing outcomes
(Cluster) Randomized Controlled Trials																						
Abraham	2019																					
Updated version			1				1	1			1	1			1		1	1 a			9	NC	NC
Concise version			1				1					1			1		1	1 a			7	NC	NC
Control							1														1	NC	NC
Beeckman	2013																					
Intervention (Intrinsic-motivation oriented strategies)			1		1		1	1		1		1			1		1	2¥, a			11	P	P
Control							1	1													2	NC	NC
Cheater	2006																					
Audit and feedback (AF)			1				1														2	NC	NC
Educational outreach (EO)			1				1	1	1							1					6	NC	NC
AF + EO			1				1	1	1							1					5	NC	NC
Control							1														1	NC	NC
De Visschere	2012																					
Intervention (supervised implementation)					1		1	1		1		1		1				1 a			8	-	P

| | | |

Intervention (education, patient involvement, feedback)		1			1	1			1	1	1			1			8	NC	P
Control																	0	NC	NC
Van Lieshout	2016																		
Intervention (tailored improvement programme)		1			1	1					1			1			7	NC	P
Control																	0	NC	NC
Ward	2010																		
Intervention (full-time project nurse)						1			1								3	NC	NC
Control												1					1	NC	NC
Before after																			
Seto	1991																		
Opinion leader							1		1					1			4	P	-
Lecture (control)						1											1	NC	-
Opinion leader & Lecture						1	1		1								3	P	-
Ames	2011				1	1					1						5	-	P
Bale	2004				1	1		1	1		1						6	-	P
Bjartmaz	2017				1	1			1			1					5	P	-
Cabilan	2014	1				1		1	1			1		1			7	NC	-
Cahill	2014	1					1		1					1			5	NC	NC
Choi	2014	1			1	1				1		1		1			8	P	-
Clark	2001				1	1		1		1							5	P	-
De Laat	2006							1		1							7	P	P
De Laat	2007				1	1		1		1		1					3	P	P
Downey	2015	1		1		1		1				1					6	NC	-
Duff	2013				1		1		1	1							5	-	NC
Dulko	2010	1				1											3	P	P
Edwards	2007	1				1								1			3	NC	-
Featherston	2018			1	1	1											5	P	-
Frigerio	2012				1	1			1								4	P	-
Giugliani	2010					1				1							3	-	P

Habich	2012				1																	3	P	-
Harrison	2005	1				1				1												3	-	P
Jagt-van Kampen	2015				1	1																3	NC	-
Johnson	2017	1			1			1	1	1												7	P	P
Joliffe	2019		1		1	1							1									6	P	P
Kingsnorth	2015		1		1	1		1		1		1	1									8	P	P
Koh	2018		1		1					1	1		1		1							8	P	NC
Lockwood	2018				1	1			1													5	P	NC
Lopez	2004				1	1							1									7	-	NC
Lopez	2011		1		1	1				1	1		1									5	P	P
Paquay	2010		1		1	1				1				1								6	P	P
Pun	2005				1	1							1									4	NC	NC
Reynolds	2016				1		1			1												4	NC	-
Rosen	2006			1	1	1					1		1				1$		1			8	-	P
Savvas	2014					1				1												3	NC	-
Sipila	2008		1	1	1	1		1	1	1							1£					9	NC	-
Tian	2017	1	1		1	1									1							6	NC	-
Troglic	2019		1	1	1	1	1	1	1	1		1	1		1							13	P	P
Van den Boogaard	2009		1		1		1			1			1		1							8	P	P
Vander Weg	2017		1		1	1	1			1	1	1	1				1					12	-	NC
Zhu	2018				1	1					1	1			1							7	P	-

Implementation strategies:1 All Cochrane Effective Practice and Organisation of Care taxonomy implementation strategies except: clinical practice guideline (applied in all studies), educational games and continuous quality improvement (applied in none of the studies). Delivery Arrangements: *Self-management support. ¥ - Health information systems. - Procurement and distribution of supplies. Disease management. - The use of information and communication technology. - Care pathway. Financial Arrangements: €Nurses received $50,- per meeting to acknowledge their effort in off-duty meeting. $$75,- for each staff member if the desired reduction in Pressure Ulcer incidence was achieved. $10 for attending training session. £Facilitators per site were motivated by a small financial increment on their monthly salary. For the patients, first $10,- then $20,-. Governance arrangements: Professional competence. NA Not applicable ; NC no change ; P positive

Barrier assessment

A barrier assessment was performed in twenty-three (43%) studies. 'Nineteen studies explicitly used the outcomes of the barrier assessment to select tailored implementation strategies. Lack of knowledge was the most common found barrier, described by eleven studies (48%). Other barriers were accessibility of products (6%), time limitations (4%), and lack of leadership/motivation (4%). There was no difference in studies who described a positive significant effect on patient-related nursing outcomes or guideline adherence between studies that did or did not perform a barrier assessment. From the studies which measured patient-related nursing outcomes, eleven studies performed a barrier assessment, of which seven reported a positive significant effect on patient-related nursing outcomes, and four did not report a change (Pearson Chi-Square 0.335, df 1, p=0.56). From the studies which measured adherence, nineteen studies performed a barrier assessment, of which twelve showed a positive significant effect on adherence (Pearson Chi-Square 0.229, df 1, p=0.63).

Use of Implementation theory, models or frameworks

Seventeen (31%) studies used a theory, model or framework. The Johanna Briggs Institute Getting Research in to Practice model was used in six studies, the Implementation Model of Change by Grol and Wensing in four, and the Promoting Action on Research Implementation in Health Services in two. The Normalisation Process Theory, Knowledge to action model, Theory of Change, AIM model, and Awareness Desire Knowledge Ability Reinforcement (ADKAR) Change management model were used once. Nine of the studies which measured patient-related nursing outcomes used a theory, model or framework, of which six reported a positive significant effect on patient-related nursing outcomes (Pearson Chi-Square 0.68, p=0.79). Sixteen of the studies which measured adherence used a theory, model or framework, of which eight reported a positive significant effect on adherence (Pearson Chi-Square 0. 860, p=0.35).

Study duration

The duration of the implementation studies varied widely, from a few weeks up to several years. Some studies used point prevalence measures, others used continuous data. Several studies did not describe the duration and/or interval of the measurements performed. Seventeen studies did not mention the duration of the baseline measurements, twenty-four the implementation phase, and eleven the post-implementation phase.

Overall, among the studies providing the respective information, baseline measurements were collected over a median period of three months (IQR 1-6), and the implementation phase lasted a median of three months (IQR 2-9.5). The post-implementation phase had a median duration of 3.5 months (IQR 1.75-6.0). Fourteen studies performed a second post-implementation measurement, with a median duration of 6 months (IQR 3.8-12.8). One study performed a third post-implementation measurement lasting 16 months.

DISCUSSION

To our knowledge, this is the first systematic review on the effects of implementation of nursing guidelines in all fields of practice and the used implementation strategies. The broad view across the field of implementation science regarding nursing guidelines identified a diverse range of implementation strategies, combinations of different strategies, guidelines, outcome measures and settings. These findings provide a good reflection of current practices and considerations. We presented the findings as a descriptive and narrative synthesis because a meta-analysis was not possible in view of the heterogeneity of guidelines, implementation and clinical outcomes, the variety of used (combinations of) strategies and the varying timing in follow-up measurements among the included studies.

More than half of the studies showed a significant positive effect of the implementation of nursing guidelines on patient-related nursing outcomes and/or adherence to the guideline(s). There was no association between relative change on patient-related nursing outcomes and the number of implementation strategies in total or the use of combined strategies from the different EPOC categories. There was a significant difference in the relative change in favour of the before-after studies, however this seems to be related to the study design. There is not one strategy, or combination of strategies, which can be linked directly to successful implementation. We could not assess whether implementation success was related to the use of a theory, model or framework, performing a barrier assessment or using tailored strategies, due to the small number of studies describing this.

In line with findings from previous reviews[12,79], we found that education was the most used strategy to implement evidence-based nursing, and noted that education is less to moderate effective on its own[80,81]. However, somewhat less than half of the studies that performed a barrier assessment found a lack of knowledge as a barrier. In contrast to other medical professions, nurses are not always –differs per country– required to take continuing education courses to keep their licensing[82]. Taken that into account, it makes sense to apply at least an educational strategy for the implementation of nursing guidelines.

In this review, it was identified that most strategies were quite traditional, such as using posters and written material, instead of apps, screensavers, or educational games. Several studies recommend investing in online and social media, which can substantially advance implementation science[83-85].

The scope of this review was to get a complete overview of strategies used to implement nursing guidelines, and subsequently get insights in the effects of implementation strategies across all settings and guideline topics. We were able to gain insight in the strategies used on a regular basis. Nevertheless, because of the varying strengths and limitations of the included studies, we could not identify a single or combination of implementation strategies that is most effective in getting nursing guidelines into practice. We think that narrowing the scope of settings and guideline topics will not result in better understanding of the effectiveness of implementation strategies. Only a comparison of studies with detailed descriptions of the delivered strategies and the same timeline might achieve this.

Strengths and Limitations

This review has several strengths and limitations. First, we are confident that we present a complete overview of implementation studies regarding nursing guidelines. Most studies were found with the initial search strategy. Second, due to the collaboration in data extraction between TR, EI and DS we warranted that the collected data from the individual studies are reliable. Repeated discussion about several implementation strategies led to a better understanding of the individual data, and resulted in a consistent reliable assessment of each included study. Third, for the interpretation of the effectiveness of the implementation strategies the outcomes were dichotomized into effect or no effect for patient-related nursing outcomes or guideline adherence. Using these two primary outcomes to assess the impact of the implementation studies is consistent with Curran et al.[86]. These authors suggest that a dual focus in assessing clinical effectiveness and implementation could speed the translation of research findings in routine practice.

A limitation is the quality of the before-after studies, which resulted in an overall low evidence base, precluding drawing conclusions. Which caused a high risk of bias across all studies, so caution is needed in drawing conclusions.

A second limitation is the probable publication bias, in that studies achieving negative results tend to go unpublished. Still, nearly half of the published studies showed no change.

A third limitation regards the wide variety in degree of details of the used strategies. All described implementation strategies classified according the EPOC taxonomy independent to the provided description and operationalisation of the strategy were considered equally in this study. It can be questioned, however, whether the described implementation strategies were comparable for all studies that used the same type of strategies. The potential lack of comparability may have affected the interpretation of the effects of the implementation strategies. Strategies were poorly described and operationalized; for example, only the type of strategy was provided, such as audit and feedback. We propose that strategies must be precise enough to enable measurement and reproducibility, following the recommendation of Proctor et al.[87] or using The Standards for Reporting Implementation Studies (StaRI) Statement[88]. These checklists could help standardize the way these studies are described. To fully understand the effect of a strategy such as audit and feedback, information on the extent, the number of audits and the fraction of the participants in the target group must be available.

Fourth, calculating the relative change for controlled studies and before-after studies separately might lead to an overestimation for the before-after studies, and an underestimation for the controlled studies. In some controlled studies there were signs of contamination between groups, what could have caused an effect in the control group, thus leading to an underestimation of the relative change.

Lastly, we found a wide variety in the duration and interval of measurements, and many studies did not provide an indication of their baseline, implementation and/or post-implementation phase, or provided a 'short' follow-up. An adequate follow-up time provides information about the sustainability; i.e., whether the guideline is maintained or institutionalized within a service setting's ongoing, stable operations[87]. The problem is of course that research projects are sponsored for a limited period and evaluating the long-term effects are often not feasible.

Recommendations

We recommend well-designed studies to test the effectiveness of implementation strategies. In future research the implementation details should ideally be reported according to standardized formats, for example as suggested by Proctor et al.[87] or Pinnock et al.[88]. A more detailed description of the implementation process makes it easier to understand the change mechanism. Abraham et al.[37] provided a detailed supplemental file containing the components, description and actual

dose delivered of their intervention components. This inventory is helpful for future research, but also for clinical practice.

We recommend guideline developers to think about audit criteria while developing a nursing guideline. Most studies described developing an audit criteria checklist as one of their preparations. A predefined audit criteria checklist could help healthcare professionals and organizations in the execution, goal-setting and evaluation of the implementation of nursing guidelines. We noted a lack of goal-setting in most studies. The study of Jolliffe et al.[76] was one of the exceptions: the goal was for staff to adhere to minimally 75% of applicable guideline indicators per patient prior to commencing the study. When pre-defined audit criteria are available it might be possible to set goals and evaluate the implementation of guidelines without extensive preparations.

Less than half of the studies included in this review performed a barrier assessment, and most were poorly described. Further, we could not relate performing a barrier assessment to a positive effect on the primary outcomes. Four studies that performed a barrier assessment did not state that the identified barriers were used to select the implementation strategies. In line with other reviews, we think that tailoring strategies based on a barrier assessment is important[8,9,14]. A barrier assessment can provide crucial information about the context where the implementation will take place. Finding and describing barriers and facilitators in detail can help in choosing adequate implementation strategies, this may increase the effectiveness of the implementation of nursing guidelines.

CONCLUSION

This systematic review provides an extensive, up-to-date review of the implementation of nursing guidelines and the used implementation strategies. More than half of the studies showed a positive significant effect of the implementation of guidelines on patient-related nursing outcomes or guideline adherence. A wide variety of implementation strategies were identified in implementing nursing guidelines. Education is the most frequently used strategy to implement nursing guidelines in practice. Not one single strategy, or combination of strategies, can be linked directly to successful implementation of nursing guidelines. Consistency in reporting of the used implementation strategies and the duration of measurement of the impact of the strategy should be improved in future studies.

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SUPPLEMENTAL FILES

Supplement 1. Search strategy

Table 3. *Search strategy*

embase.com	**Hits**
('practice guideline'/de OR 'nursing protocol'/de OR 'good clinical practice'/de OR 'nursing care plan'/de OR 'protocol compliance'/de OR 'clinical protocol'/de OR 'evidence based nursing'/de OR standard/de OR 'evidence based medicine'/de OR (protocol* OR guideline* OR (evidence-based NEAR/3 (nurs* OR pratice*))):ab,ti) AND ('nursing'/exp OR 'nurse'/exp OR (nurs*):ab,ti) AND ('implementation'/de OR 'dissemination'/de OR 'information dissemination'/de OR (implement* OR disseminat* OR (knowledge NEXT/1 (translation* OR transfer*))):ab,ti) AND ('protocol compliance'/de OR 'behavior change'/de OR (complian* OR adher* OR noncomplian* OR nonadher* OR (behav* NEAR/3 change*) OR effect*):ab,ti) NOT ([Conference Abstract]/lim OR [Letter]/lim OR [Note]/lim OR [Editorial]/lim)	5268
Medline Ovid	
(Practice Guidelines as Topic/ OR Patient Care Planning/ OR Guideline Adherence/ OR Clinical Protocols/ OR Evidence-Based Medicine/ OR Standard of Care/ OR Evidence-Based Medicine/ OR (protocol* OR guideline* OR (evidence-based ADJ3 (nurs* OR pratice*))).ab,ti.) AND (nursing/ OR nurse/ OR (nurs*).ab,ti.) AND (Health Plan Implementation/ OR Information Dissemination/ OR (implement* ORdisseminat* OR (knowledge ADJ (translation* OR transfer*))).ab,ti.) AND (Guideline Adherence/ OR (complian* OR adher* OR noncomplian* ORnonadher* OR (behav* ADJ3 change*) OR effect*).ab,ti.) NOT (letter* OR news OR comment* OR editorial* OR congres* OR abstract* OR book* OR chapter* OR dissertation abstract*).pt.	4249
Web of science	
TS=(((protocol* OR guideline* OR (evidence-based NEAR/2 (nurs* OR pratice*)))) AND ((nurs*)) AND ((implement* OR disseminat* OR (knowledge NEAR/1 (translation* OR transfer*)))) AND ((complian* OR adher* OR noncomplian* OR nonadher* OR (behav* NEAR/2 change*) OR effect*))) AND DT=(article) AND LA=(english)	2805
Cochrane CENTRAL	
((protocol* OR guideline* OR (evidence-based NEAR/3 (nurs* OR pratice*))):ab,ti) AND ((nurs*):ab,ti) AND ((implement* OR disseminat* OR (knowledge NEXT/1 (translation* OR transfer*))):ab,ti) AND ((complian* OR adher* OR noncomplian* OR nonadher* OR (behav* NEAR/3 change*) OR effect*):ab,ti)	972

CINAHL EBSCOhost	
(MH Practice Guidelines OR MH Guideline Adherence OR MH Medical Practice, Evidence-Based OR TI(protocol* OR guideline* OR (evidence-based N2 (nurs* OR pratice*))) OR AB(protocol* OR guideline* OR (evidence-based N2 (nurs* OR pratice*)))) AND (MH nurses+ OR TI(nurs*) OR AB(nurs*)) AND (MH Program Implementation OR TI(implement* OR disseminat* OR (knowledge N1 (translation* OR transfer*))) OR AB(implement* OR disseminat* OR (knowledge N1 (translation* OR transfer*)))) AND (MH Guideline Adherence OR TI(complian* OR adher* OR noncomplian* OR nonadher* OR (behav* N2 change*) OR effect*) OR AB(complian* OR adher* OR noncomplian* OR nonadher* OR (behav* N2 change*) OR effect*)) NOT PT(letter* OR news OR comment* OR editorial* OR congres* OR abstract* OR book* OR chapter* OR dissertation abstract*)	1740
Google scholar	
protocol|guidelines|"evidence-based nursing|pratice" nurse|nurses|nursingimplementation|dissemination|"knowledge translation|transfer" compliance|adherence|noncompliance|nonadherence|"behavior|behaviour change"|effect	698
PsycINFO Ovid	
(Treatment Guidelines/ OR Treatment Planning/ OR Professional Standards/ OR Evidence Based Practice/ OR (protocol* OR guideline* OR (evidence-based ADJ3 (nurs* OR pratice*))).ab,ti.) AND (nursing/ OR nurses/ OR (nurs*).ab,ti.) AND (Information Dissemination/ OR (implement* ORdisseminat* OR (knowledge ADJ (translation* OR transfer*))).ab,ti.) AND ((complian* OR adher* OR noncomplian* ORnonadher* OR (behav* ADJ3 change*) OR effect*).ab,ti.) NOT (letter* OR news OR comment* OR editorial* OR congres* OR abstract* OR book* OR chapter* OR dissertation abstract*).pt.	200

SUPPLEMENT 2. DESCRIPTION OF INCLUDED STUDIES

Table 4. Description of included studies, in alphabetic order

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Abraham, 2019, Germany	Cluster RCT, Nursing home – 120 nursing homes, Multi centre, Mobility – physical restraint use Before: Unclear Impl: Unclear After: 6 and 12m	Not specified. -- Total sample: *n*= 8800. Intervention 1: *n*=2972, Intervention 2: *n*=2523, control: *n*=3305, mean age 83.5 (SD10) Females 73%	Interventions were implemented on cluster level. Intervention group 1 received an updated version of the original program. In each cluster key nurses received intensive training, followed by structured support for three months. All nurses were offered with a 90-minute information session. A policy statement addressing a least-restraint policy was signed by the nursing home leader. Intervention group 2 received a concise version, comprising the intensive training for the key nurses, the organizational component and all supplemental materials.	Primary: Compliance The primary outcome (mean physical restraint prevalence on cluster level) was 17.4% at baseline in intervention group 1, 19.6% in intervention group 2 and 18.8% in the control group. After twelve months, prevalence declined in all study groups (14.6% intervention group 1, 15.7% intervention group 2, 17.6% control group) (Table 2).The baseline-adjusted difference between intervention group 1 and control group was -2.0% (97.5% CI, -5.8 to 1.9; P = .25) and between intervention group 2 and control group -2.5% (97.5% CI, -6.4 to 1.4; P = .14). Both differences were not significant on the level of 0.025 (Bonferroni-adjusted) Secondary: Intervention's effect The number of residents with at least one fall or fall-related fracture during the study period did not differ statistically significant between groups. There was also no statistically significant difference in the mean number of falls per resident and in the mean number of falls per resident with at least one fall (Table 8).	No change	No change

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Ames, 2011, USA	Before-After, Hospital - 4 different critical care units, Multi centre, Infection prevention - Prevention of Ventilation Acquired Pneumonia (VAP) Before: 11 m Impl:2 m After: 14 m	Not specified. Sample size: Control; *n*=51 Treatment; *n*=65 Divided over 3 hospitals.	A structured educational program. Initial introduction by researcher, a dentist or dental hygienist provided each patient care unit with instructions. Education was repeated several times, according to each units need and current staff. A recorded educational session was available on all units for the nursing staff. A pocket-flip chart-booklet was distributed to all patients in an oral care kit. Containing chlorhexidine spray, a child's toothbrush, an instruction booklet and an oral care documentation card.	Primary: Patient-related nursing outcomes measured with Beck Oral assessment scale (BOAS), Mucosal plaque score. Results indicated a significant difference among the 3 times (p=0.01) with no difference in the pattern of scores between treatment and control groups and time (p=0.21) The pattern of BOAS scores differed significantly across the 5 days depending on the group (p=0.02). The difference in BOAS scores was also significant over time, day 1, 3, or 5 (p=0.009),and between groups, treatment or control, (p<0.001).	NA	Positive

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Bale, 2004, USA	Before-After, Nursing homes - 6, Multi centre, Skin care Before: 6 m Impl: at least 3 m After: Unclear	Not specified. Sample size: Before: *n*=79. After *n*=85	Educational meetings regarding: The educational programme: All staff received a basic educational programme that comprised three elements: 1. A lecture on the physiology and pathophysiology of the skin 2. A group discussion to highlight and clarify areas of uncertainty 3. An interactive session that outlined the skin care protocol to be implemented, which included a demonstration of how and when to use the new skin care products. All patients were provided with their own individual skin care protocol, a laminated card detailing the products to be used and the frequency of application, which was usually kept at their bedside.	Primary: Adherence. 99% post (no before measurement) Secondary: Patient-related nursing outcomes; Mild incontinence dermatitis Before *n*=13, After *n*=2 (*p*=0.021) Pressure ulcer damage grade 1 Before *n*=16 After *n*=8 (*p*=0.042)	NA	Positive

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Beeckman, 2013, Belgium	Cluster Randomized Controlled Trial, Nursing home - 11 wards, Multi centre, Skin care - pressure ulcer care Before: 1 d Impl: 4 m (4 data points) After: Directly after implementation (d 120)	Sample size: Intervention: *n*=65. Control: *n*=53. 89.2-98.1% females. Nurse assistants 43.1-49.1% Diploma nurse 18.9-21.5% Bachelor nurse 10.8-13.2% Sample size: Intervention: *n*=225 Control n=239. 76-82.8% females. 25.8-26.4% at risk for pressure ulcers	Electronic clinical decision support system, multi-faceted tailored implementation containing; (interactive) education, monitoring and feedback, reminders, leadership. Availability of preventive materials. Nurses in control group were provided with pressure ulcer prevention protocol in hard copy format.	Primary: Adherence. Behavioural change of the professionals. A significantly overall positive effect was found on the allocation of fully adequate proportion when seated in a chair. 60% vs 13.2% (p=0.003) Residents receiving no prevention was significantly lower. Secondary: Knowledge & Patient-related nursing outcomes. Pressure ulcer prevalence was significantly lower for cat 1-4, no difference in cat 2-4. No difference in knowledge of professionals appeared, attitude did improve significantly.	Positive	Positive

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Bjartmarz, 2017, Iceland	Before-After, Hospital - Neurology and rehabilitation ward in university hospital, Single centre, Stroke care Before: Nursing 3 m, patients 1 y Impl: 8 m After: Nursing: Quantitative unclear; Qualitative 10/11 m Patients: 1 y	Sample size: *n*=33, registered nurses *n*=18 (54%) Nursing auxiliaries *n*=15 (46%) Sample size: *n*=78. Before: *n*=44 Mean age 65.6 (13.12) 34% females. After *n*=34 Mean age 58.2 (17.9) 47% females	Registered nurses and auxiliary nurses received both plasticized printed and digital version. Education and training sessions (one 4h education) opinion leaders (*n*=7). Posters and reminders. Regular emails explaining the intervention protocol.	Primary: Adherence. Documentation of the 37 items on screening and application of key interventions in stroke care, was improved in 23 items after implementation. Significant improvement was found on the six following items: a) three items in ADL and mobility: Assess with Functional Independence Measure < 72 h of admission (p = 0.002), Mobilization facilitation within 24 h (p = 0.024), Training of ADL (p = 0.022) and b) three items on patient education: Patient education (p = 0.001), Educational brochure provided (p = 0.000) and Education repeated (p = 0.049). No change was found in the documentation of five items (4 pain variables, 1 depression). Significant worse documentation was found for the item Patients asked about pain (p = 0.012), whereas the worse documentation on the remaining eight items was non-significant (3 ADL, 4 pain, 1 depression).	Positive	NA

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Cabilan, 2014, Australia	Before-After, hospital, Single centre, Infection prevention - Peripheral cannula infections Before: 2 m Impl: 1 m After: 5 m	Not specified. Sample size: before: *n*=20 after: *n*=20	Organisational change in protocol. Form for standard documentation was made available. Audit and feedback, reminders, 15-minute educational meetings.	Primary: Adherence. Based on 8 audit points. No statistical tests performed.	No change	NA
Cahill, 2014, Canada / USA	Before-After feasibility study, hospital - 5 participating Intensive Care Unit's (one divided in 3 units) in Canada and the USA. In non- and teaching hospitals, Multi centre, Nutritional - Enteral nutrition in the Intensive Care Unit (ICU) Before: 6 m or less Impl: 12 m After: 6 m	ICU nurses - all critical care staff, of which 74% were nurses at baseline. In follow-up 79%. A response rate of 39% for nurses Sample size: Before: *n*=140. After: *n*=138. Median age 61 (IQR 51-72). 45% females. Median 27 (IQR 23-32) BMI	Local nutrition opinion leaders in an interdisciplinary team were responsible for study coordination, data collection, and implementing the tailored intervention. Other strategies used were audit & feedback, and educational outreach.	Primary; Adherence and experience based on survey outcomes. Secondary: Patient-related nursing outcomes: The change in caloric adequacy from total nutrition at each site. While some sites did not improve, an increase of >10% was observed at two sites (51 to 63% at Site 1, and 39 to 57% at Site 4). Similar results were observed for protein adequacy from total nutrition. No significant effect.	No change	No change

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Cheater, 2006, United Kingdom	Cluster Randomized Controlled Trial, Family practice, Multi centre, Urinary incontinence Inclusion: over 6 w Follow-up: 6 m	Family practice nurses. Sample size: *n*=176 Sample size: Before *n*=966, Post: *n*=700 (Control *n*=166, AF *n*=166, EO *n*=179, EO+AF *n*=166)	Comparison of Audit & Feedback (AF), Educational Outreach (EO), AF + EO and control group. AF; personal feedback on performance, consisted of tables and text, highlighting good practice and areas for improvement. Including educational material. EO; personal feedback, 1 to 3 EO visits by link nurses and minimum of 1 follow-up telephone call. Link nurses are community nurses with special interest in continence care. Control: received only educational material.	Primary: individual adherence rates showed no evidence of improvement. There was some evidence to suggest a negative interaction between AF and EO. Moderate improvement in patient management criteria, but similar across all groups. Secondary: Patient-related nursing outcomes, no marked differences in improvement for specific symptoms, severity score and use of UI absorbent pads.	No change	No change
Choi, 2014, South-Korea	Before-After, hospital - A university affiliated tertiary hospital , Single centre, Pain - cancer related Before: Unclear Impl: Unclear After: 6 m	Not specified No description	Providing a better understanding in Evidence Based Practice. Modification of Electronic medical record, posters, leaflets, hard copy instructions for documentation. Meals and refreshments were provided. Tailored time before/after shift. Managerial and research team supervision was provided, feedback on documentation was provided informally.	Primary: Adherence. 4 criteria measured. 1 criteria 100% adherence at baseline and after. Criteria 2,3,4 showed a positive significant change. Secondary: Patient-related nursing outcomes: No significant difference in pain intensity between baseline and follow-up	Positive	NA

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Clark, 2001, United Kingdom	Before-After, hospital - a large teaching hospital , Single centre, Blood transfusion Before: unclear. Impl: > 3 m After: 18 m	Not specified. No data collection	An educational package, developed by hospital's nurse educators, transfusion nurse specialist and medical staff. A lecture in the first three months of the programme was provided to the majority of senior nurses. The senior nurses acted as instructors for other members of staff in their wards.	Primary: Adherence. Significant effect on adherence 5 out of 7 audit criteria.	Positive	NA
De Laat, 2006, Netherlands	Before-After, University hospital, Single centre, Skin care - pressure ulcer Before: 2 separate 1 day measurements in a year Impl: unclear After: 4 m, 1 d measurement 2nd After: 11 m, 1 d measurement	Not specified. Sample size: Before: *n*=7657. After: *n*=735 2nd After: *n*=755	A pressure ulcer consultant was appointed and established a network of contact nurses (one on every ward). This contact nurse was trained by the nurse consultant and introduced the new guideline in a staff meeting or clinical lesson. After the official introduction of the guideline, the existence of the guideline was announced in several hospital media (newspaper, intranet). Furthermore, all hospital bed frames were equipped with a high quality pressure reducing viscoelastic foam mattress.	Primary: Adherence 1. The changes in adherence with prevention activities (mattress included) were significant (p<0.000). Without mattress, these changes were statistically insignificant. 2. The changes in adherence with treatment activities (mattress included) were significant (p<0.016). Without mattress, these changes were statistically insignificant. Secondary: Patient-related nursing outcomes. Groups I–IV, frequency of pressure ulcers patients grades I – IV in all patients (*n*=2147). The decreases in prevalence were significant (p<0.009). Groups II–IV, frequency of pressure ulcers patients grades II – IV in all patients (n=2147). The decreases in prevalence were significant (p<0.011).	Positive	Positive

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
De Laat, 2007, Netherlands	Other, hospital - Critical care unit in an academic hospital, Single centre, Skin care - pressure ulcer Before: 3 m Impl: 3 m After: 3-6 m 2nd After: 12-15 m	ICU nurses. Not specified Sample size: Baseline: *n*=110 age 59.7(16) Females 38%. After *n*=130 age 57.6(15) females 38%. 2nd After *n*=159 age 58.1(16) females 42%.	A pressure ulcer consultant was appointed in the study hospital and established a network of so-called contact nurses (one on every nursing ward and Intensive Care Unit). These contact nurses were trained by the nurse consultant and introduced the new guideline in a staff meeting or clinical lesson on the Intensive Care Units. After the official introduction of the guideline at the end of the baseline period, the existence of the guideline was announced in several hospital media (newspaper, intranet).	Primary: Patient-related nursing outcomes. Pressure ulcer incidence; decrease with (p=0.04). Pressure ulcer free time; increased with (p=0.01) NNT after 1 y was 6 (p=0.02). Secondary: Adherence. Adequate mattress use increased from 28% at baseline to 60% in period III (p=0.003).	Positive	Positive
De Visschere, 2012, Belgium	Cluster Randomized Controlled Trial, Nursing homes - In Flanders Belgium, Multi centre, Oral care Before: Unclear Impl: Unclear After: 6 m	Not specified. Sample size: Control: Before *n*=186 After *n*=146. mean age 84.5(8.5) females 68,4% Intervention: Before: *n*=187 After *n*=151 mean age 84.9(7,6) 78% females	A supervised implementation, in each institution a project supervisor was appointed. An oral healthcare team was installed, consisting of an institution project supervisor, two oral healthcare organizers (nurse/nurse aides), a physician and optionally an occupational or speech therapist. A 1,5h informative oral presentation of the protocol was provided. A 2 h lecture and 1h practical education session and a 1,5h theoretical and executive education session at each ward was provided. Residents were provided a free-of-charge oral healthcare materials and products	Primary: Patient-related nursing outcomes. Oral hygiene level; dental, denture and tongue plaque. Significant differences were observed between the intervention and control group for mean denture plaque at 6-month follow-up (p<0.01).	NA	Positive

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Downey, 2015, Australia	Before-After, hospital - A 18 bed Head, neck and lung medical oncology ward, Single centre, Crushing medication in case of Tube feeding only Before: 4 w Impl: Unclear After: 5 w	Not specified. No description.	A number of improvement strategies were implemented using targeted education sessions with the sole focus on improving medication modification methods for this patient cohort.	Primary: Adherence. No statistical test performed. An observational change is shown for all 3 criteria. Safe preparation before 45% after 91%. Optimal preparation before 33% after 60%. Not prepared accordingly before 55% after 9%.	No change	NA

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Duff, 2013, Australia	Before-After, hospital - a 250-bed magnet designated private hospital, Single centre, Prevention of venous thromboembolism (VTE) Before: unclear Impl: 2 m After: unclear	Most were registered nurses. Population divided in Received intervention and declined. Received *n*=85, median age 29 (25-35) 86% females. Declined *n*=35 86% females Total sample: *n*=192. Before: *n*=98 Median age 72 (58-82), 56.1% females. After: *n*=94, median age: 75.5 (63.5-85) 46.8% females	Educational outreach visits, with an expert registered nurse in VTE as EO facilitator. The research team attended a 2-day intensive workshop. The content of the EO was limited to 4 key messages.	Primary: Experience, acceptability, utility. Acceptability measured with survey, 76 nurses returned the post-intervention, 97% felt that EOV was effective or extremely effective to increase their knowledge about VTE prophylaxis for medical inpatients. Utility: process outcomes in planning, time spent, adherence and location. Secondary: Patient-related nursing outcomes. There was no measurable improvement in the proportion of patients with a documented VTE risk assessment after the intervention period (10.2% to 8.5%;1.7% improvement; *p*=0.68). There was also no improvement in the proportion of patients who received appropriate mechanical VTE prophylaxis (42.8% to 42.6%; 0.3% improvement: *p*=0.96). Removing patients who were at low risk for VTE from the analysis made no difference to this result (37.2% to 40.2%; 3.0% improvement; *p*=0.68)	NA	No change

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Dulko, 2010, USA	Before-After, hospital, Single centre, Pain - cancer related Before: 3 m Impl: 3 m After: unclear	Sample size: Nurse Practitioners *n*=8 Sample size: Before: *n*=96 Mean age 58 (SD 13,5) Range 24-86 After *n*=96 Mean age 59 (SD 11,5) Range 3-82. 59% females in both groups	Educational meeting of 30 minutes where feedback on baseline data was discussed with NP. A laminated pocket-sized version of the guideline was provided to the NP's which included the selected audit criteria. During intervention the NP's were given weekly feedback on patient pain scores and adherence to guideline criteria during a 15 min session. If no face-to-face meeting was possible a sealed envelope with the feedback was provided. Feedback on pain scores, mean pain ratings, and highest level of pain were provided in graph form. In addition to individual practice feedback, each NP was provided with aggregate data of overall patient pain scores and NP performance for all patients. All data were identified by a code number and placed in a sealed envelope. Practice data were kept confidential and only aggregate data were shared with the institution.	Primary: Adherence. There was a great deal of variability in the overall adherence rates for each of the eight criteria during the pre-intervention phase. During the intervention phase, six of the eight criteria had a ≥87% adherence rate, including initial pain reassessment by the prescribing NP within the suggested timeframe, which had been at only 5% during the pre-intervention phase. Adherence rate for initial comprehensive pain assessment increased from 1% to 43% (p=0.008). The adherence rate for repeat comprehensive pain assessment remained low during the intervention phase (7%). Less lorazepam prescriptions in intervention phase. Secondary: Patient-related nursing outcomes. There was a significant difference between pre-intervention and intervention group patients for overall pain interference (p<0.001) interference with general activity (p=<0.0001), and interference with sleep (p=<0.004).	Positive	Positive

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Edwards, 2007, Canada	Before-After, Hospital and nursing homes - 7 hospitals + 2 home visiting nursing service organisations and one public health unit, Multi centre, Combination of multiple guidelines - Asthma, breastfeeding, delirium-dementia-depression, smoking cessation, venous leg ulcers, diabetes Before: 6 to 8 w Impl: unclear. After: 6 to 9 m with a duration of 6 to 8 w	Sample size: *n*=257. 93.7% females. 72.5% >6 years' experience. 77.7% working full-time. 35.5% bachelor or higher No description	At each site, a clinical research nurse (CRN) led implementation of the BPG recommendations. CRNs used a multi-strategy approach including educational sessions with staff nurses, reviews of policies and procedures with administrators and staff nurses, and modelling new clinical skills such as implementing and demonstrating the utility of new assessment tools or providing smoking cessation counselling. A standard toolkit was used by nurses to guide their BPG implementation activities. Regular Teleconference calls with the program director provided an opportunity for CRNs to address problem issues and to share their implementation strategies. CRNs tailored their implementation strategies to the organizational context, the patient population needs and the clinical gaps as assessed by their organization through patient satisfaction surveys and quality assurance programs.	Primary: Adherence measured with referral rates. For three BPGs (delirium-depression-dementia, smoking cessation and venous leg ulcer), a sequential sample of patient charts was retrieved from medical records for a period of six to eight weeks pre- and post-implementation; There were some distinctive referral patterns reported by nurses, documented in the charts and ascertained through patient interviews. These included higher rates of referrals for services that were part of the organization where nurses were employed and almost a complete lack of referrals to Internet sources. In addition, for one of the BPGs (venous leg ulcers), the only statistically significant increase in referrals to individual resources observed on the chart audit was to other nurse specialists (e.g. enterostomal nurse or wound care specialist; 28.2% versus 50.6%, $p<0.0001$).	No change	NA

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Featherston, 2018, USA	Before-After, Community mental health centre, Single centre, Paediatric mental healthcare Before: 2 w Impl: 12 w After: total 12 w	Sample size: *n*=4 psychiatric mental health nurse practitioners. *n*=2 psychiatrists Sample size: *n*=70 No description	Hard copy checklist to prompt recommended screenings. During the pilot study, multiple processes, such as use of the checklist, clinic flow changes, laboratory ordering, and receiving of results, were tested and the feedback was incorporated. The checklist and process were modified to reflect necessary changes in process flow optimisation.	Primary: Adherence: 7 criteria, all showed a significant positive change. With a gain percentage between 16% and 40%	Positive	NA
Frigerio, 2012, Italy	Before-After, hospital - 6 Orthopaedic Surgery, 2 Traumatology, 1 Neurosurgery, 1 Neurology, 1 General Surgery, 2 General Medicine, Single centre, Infection prevention - Peripheral venous catheter management Before: 2 d measurements Impl: unclear After: 2 d measurements 4 m after baseline.	Sample size: Baseline data in the survey group. *n*=238 Mean age: 35.7(6.8) range 32-38.1. Mean years of experience 9.2(6.7) Range 5.7-12.4 No specified description of educational level. No data collection	A taskforce was established to revise Peripheral Venous cannula's protocol according to CDC guidelines. Consisting of 2 nurses from hospital Quality Office and 2 nurses from infection control committee. These nurses trained liaison nurses from each ward. The liaison nurses presented the poster, circulated the protocol using strategies most appropriate to their own settings, informed the ward managers, provided nurses with copies. During dedicated and/or informal meetings	Primary: Adherence. management of Peripheral Venous cannulas . The new protocol significantly improved the management of Peripheral Venous cannulas .Indeed the risk of using inappropriate dressing was significantly reduced (OR 0.43;95% CI 0.27-0.70), while the use of transparent dressing increased OR 2.39;95% CI 1.46-3.89). Secondary: Patient-related nursing outcomes. There were also increased numbers of cases of tenderness and induration around the insertion site or along the cannulated vein (OR 1.84; 95% CI 1.12–3.02), but the differences were not statistically significant.	Positive	NA

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Giugliani, 2010, Angola	Cohort with historical controls, hospital - Therapeutic feeding centre, consists of a separate ward for severely malnourished children only., Single centre, Nutritional - Malnutrition care in rural Africa Before: 7 m Impl; 7 m After: NA	Sample size: *n*=18 nurses. *n*=14 basic level (2 years of midlevel general nursing training) and *n*=4 medium (4 years of mid-level general nursing training) Sample size Before: *n*=358. After: *n*=379. No specific description provided	Physician supervision, a 1-day workshop regarding basic concepts of malnutrition. Supervision of physician and a general practitioner to review cases interactively and educationally. At proposal of the nurses a study group started to form a review on the WHO guidelines.	Primary: Patient-related nursing outcomes: Positive effect on successful treatment rates (increase 13% RR1.13; 95% CI 1.04 to 1.22). Fatality declined from 15.6% to 8.7%, RR 0.56; 95 CI 0.37 to 0.83.	NA	Positive

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Habich, 2012, USA	Before-After, hospital - Paediatric Intensive Care Unit at a community hospital located in a suburb of Chicago, IL, Single centre, Pain - Paediatric pain assessment and management guidelines Before: Unclear Impl: Unclear After: 3 m 2nd After: 6m	Sample size: *n*=51 nurses (49 completed education). No specific description No description	A computer-based course. Introduction of the new guideline. New electronic medical record system.	Primary: Knowledge and attitude. No statistical difference between nurses' knowledge and attitudes regarding paediatric pain before and after implementation of the guideline was found. Secondary; Adherence. A significant increase in minimum pain assessments was noted at T2 and T3 compared with T1 ($p<0.001$). Results also showed at T3 that patients were assessed for pain using a developmentally and clinically appropriate scale compared to T1 and T2.	Positive	NA

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Harrison, 2005, Canada	Before-After, home care - The Ottawa Community Care Access Centre, an eastern Ontario home care-authority, Multi centre, Skin care - Leg ulcers Before: 12 m Impl: 2 w After: 12 m	Not specified. Sample size: total *n*= 258 . Before: *n*=78 mean age 72.7 (13.8) 66.7% females. After: *n*=180 mean age 73.4 (13.7) 60% females	Category: Authority and accountability for Healthcare professionals --> Scope of practice; Redesigning; materials. Organizational and clinical changes: switching to primary nursing delivery model. Each patient was assigned a primary nurse at admission. Community nurses received training. Clinical changes entailed adopting an evidence-informed protocol developed by an interdisciplinary task force, whose members made use of the Practice Guideline Evaluation and Adaptation Cycle	Primary: Patient-related nursing outcomes: Treatment frequency dropped significantly. Use of compression therapy increased significantly. Healing rates increased significantly. Secondary: the median supply cost per case was reduced from $1923 to $406 (*p*=0.005).	NA	Positive

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Huis, 2013, Netherlands	Cluster Randomized Controlled Trial, hospital - 3 hospitals in the Netherlands, Multi centre, Infection prevention - hand hygiene Before: Unclear. Impl: 6 m After: directly after 2nd After: 6 m	Sample size: Pre intervention: *n*=905. During: Intervention State of the Art (control): *n*=490 Intervention Team directed + state of the art: *n*=396. After: Control: *n*=518 Intervention: *n*=415. Nurses working at surgical wards, internal medicine wards, intensive care units, paediatrics No description	For the state-of-the-arts. A, education, b reminders, c feedback, d adequate products. For the team and leaders (a-d) supplemented with; e gaining active commitment, f modelling by informal leaders, g setting norms and targets within the team.	Primary: Adherence: Observed adherence rates. Analysis showed an Odds Ratio of 1.64 (p<0.001) in favour of the team and leaders-directed strategy, indicating that the difference in improvement between the team and leaders directed strategy and the state-of-the-art strategy was statistically significant. Secondary The largest decline in wearing jewellery was seen in the wards that had received the team and leaders-directed strategy, from 15% (T1) to 5% (T2) and to 3% at T3. Wearing jewellery in the state-of-the-art group decreased from 15% (T1) to 11% (T2) and then to 6% at T3. The multi-level regression analysis showed an Odds Ratio of 2.56 (p<0.01) in favour of the team and leaders-directed strategy.	Positive	NC

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Jagt-van Kampen, 2015, Netherlands	Before-After, Hospital - Academic children's hospital, Single centre, Paediatric palliative care Before: 8 m Impl: 1 m After: 6 m	5 Nurse Specialists No description	E-learning modules and an interactive educational meeting to stimulate regular review of the CPG and get familiar with using the CPG. E-learning containing a test for correctness in documentation, direct electronic feedback is provided.	Primary: Knowledge (survey). Displayed in percentage of good answers on e-learning per nurse specialist. No differences between participants, no baseline data. Secondary: Adherence. No significant change for 9 audit criteria. 3 criteria both before and after >80% adherence rate. No clear description about who gathered data and how data. Adherence also measured by asking parents about given treatment, no statement on timing of these questions; risk for recollection bias. Possible that documentation was poor, but care was sufficient.	No change	NA

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Johnson, 2017, United Kingdom	Before-After, hospital - tertiary neonatal intensive care unit, Single centre, Nutritional - improve nutrition and growth of preterm infants in neonatal intensive care. Before: 6 months. Implementation phase: 17 months. After: 6 months	Sample size: total *n*=219 Respondents were nurses' band 3 to 7 and ANNP's (Advanced Neonatal Nurse Practitioner) Total sample size *n*=198. Before: *n*=52 females 55.8%. Partial implementation *n*=36 50% females. Main implementation *n*=75 50.7% females. After: *n*=35 37.1% females	The development of the comprehensive guideline. A multi-disciplinary nutrition support team. Nurse champions seconded 1 day to nutrition team to improve knowledge and skills, the other 4 working in clinic, supporting colleagues in the new ways of working. A weekly round was introduced. Introduce improved enteral and parenteral nutrition products and nutrition team.	Primary: Patient-related nursing outcomes: Interventions effect from chart data. Data from patients adjusted for sex, gestational age and weight at birth. Significant positive change for most outcomes e.g.; change in weight SDS from birth, Mean difference in daily protein intake. Secondary: Adherence: Adherence measured with surveys, a linear regression of mean nutritional audit adherence demonstrated a significant increase with a regression coefficient of 1.1 (p=0.009)	Positive	Positive

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Kingsnorth, 2015, Canada	Before-After, Hospital - a large academic paediatric rehabilitation hospital, Single centre, Pain - Paediatric pain Before: 3 m Impl: Unclear After: 1 y 2nd After: 2 y	Paediatric registered nurses. Full and part-time clinical nursing staff. Total 89, 69 completed surveys Total sample: *n*=108. Before: *n*=35, After: *n*=33, 2nd After: *n*=40	Several strategies. Educational/ instructional resources. Electronic reminders, revised policies and standards of practice, stakeholder engagement, evaluation of practice changes, promotional activities and materials.	Primary: Adherence and Patient-related nursing outcomes. Significant reductions in overall mean pain score for each client between T1 and T3 and between T2 and T3 ($p<0.0005$). A significant and clinically relevant reduction in the frequency of ''high'' pain scores (>6) was found across the data collection windows from 65% in 2009 to 9% in 2011. Documentation of the pain scores. At T1, 1,681 of 1,848 (91%) of records were missing pain scores. At T2, this number remains high at 87%. At T3, there were no missing cases, indicating 100% (adherence; pain scores were noted for 80% (3,174/3,957) of the records, with the remaining 20% (783/3,957) coded as sleeping.) Second: Knowledge: before (mean=79%,SD=8.13) to After (mean 83%, SD=5.33, $p<0.05$).	Positive	Positive

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Koh, 2018, Singapore	Before-After, Hospital, two orthopaedic wards, Single centre, Skin care – Pressure ulcer prevention Before: 2y Impl: Unclear After: 3m, 1y 2nd After: 9m, 2y 3rd After: 16m, 3y 4th After: 24m	Not specified. Sample size: total *n*=120. Before *n*=30, After 30, 2nd After *n*=30, 3rd After *n*=30.	Education with a pictorial guide to aid nurses in performing consistent heel off-loading practice. The pictorial guide was placed on the nurses' work desk and case-file trolleys and reminders through an on-line platform from the organization.	Primary: Compliance baseline, no documentation in nursing notes. Post implementation, increase in heel-off loading 76.7% documentation 66.7% Criterion 1 showed 63.3% compliance (documented and performed) ($p<0.05$). Secondary: Intervention's effect, no statistical testing described	Positive	No change

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Köpke, 2012, Germany	Cluster Randomized Controlled Trial, nursing homes, 36 in total, Multi centre, Mobility - Use of physical restraints Before: Unclear. Several data collection points Impl: Unclear After: 3 m 2nd After: 6 m	Not specified. Sample size: total *n*=3771 Intervention: *n*=1952 Mean age 83 (10), 73% females. Control *n*=1819 Mean age 85 (9), 77% females	Posters, information evenings for relatives were encouraged. Printed versions for nurses, guardians and visitors. 1-day intensive training workshop for nominated key nurses. Structured support for key nurses. practice guideline. Printed supportive material. Publicity. NB. Usual care: head nurses received written information about the use of physical restraints and methods to avoid physical restraints, using three 12- to 24-page brochures previously developed by a Hamburg-based multidisciplinary group. Also, the topic of physical restraints was discussed during a short presentation by one of the researchers. Apart from the experimental intervention, control group and intervention group clusters were treated equally. In Germany, nursing homes are legally required that at least 50% of nursing staff be fully trained, e.g. registered, (geriatric) nurses with 3 years of vocational training. Other nursing staff have completed 1 year of training or on-the-job training.	Primary: Adherence: Physical restraint use. At baseline, prevalence of physical restraint use was comparable between groups: 31.5% in the intervention group vs 30.6% in the control group. After 6 months, physical restraint prevalence was significantly lower in the intervention group, 22.6%, vs 29.1% in the control group (difference, 6.5%; cluster-adjusted p=0.03). The eFigure provides a graphical illustration of the results. All physical restraints were used less frequently in the intervention group compared with the control group. Secondary: Patient-related nursing outcomes; for falls, fall-related fractures, and prescriptions of psychotropic medication showed no statistically significant differences between groups	Positive	Positive

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Lockwood, 2018, Australia	Quasi-experimental, hospital - Two private hospitals in a regional area, Multi centre, Mobility - Venous - thromboembolism prevention programme Before: Unclear Impl: Unclear After: Unclear	Not specified. Total *n*=383, Intervention *n*=196 mean age 66.1 (8.6), 50.5% females. Control: *n*=187 mean age 69.1(9.2), 60.4% females. (age and weight significantly different between groups)	Nurses were provided with education pamphlets. Clinical leadership by nurses' team leaders and nurse champions. The evidence-based guidelines were translated into patients clinical pathway's.	Primary: Adherence by nurses significantly higher adherence at the intervention study site. Primary: Patient-related nursing outcomes in terms of VTE and readmission rates, both showed no significant difference between study sites. Secondary: Adherence by patients. NB: No adjusted data shown, described in text that adjustment didn't lead to differences (Adjusting for operation type, admission diagnosis, age and weight resulted in negligible change to the parameter estimate for the site term). No collinearity was suggested by the computed variance inflation factors. At the control site, there was no hospital policy or clinical leadership focused on VTE prevention the participants received usual VTE prevention practices.	Positive	NC

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Lopez, 2004, China	Before-After, hospital - Tertiary care teaching hospital, Single centre, Nutritional - nutrition support in mechanically ventilated, critically ill adult patients. Before: Unclear Impl: 3 m After: 3 m	Most were registered nurses (few ward manager, nursing officer or nurse specialist). Survey sample: Before: *n*=169 76.9% females After *n*=172 80.2% females Sample size: Before: *n*=393 Mean age 62.7 (17.8) females 51.9%. After *n*=393 Mean age 63.0 (19.2) females 49.9%. Groups differed significantly on the following variables: Age, chronic respiratory disease, and current admission problem.	An educational intervention was provided over a period of 3 months. A 2-hour workshop was given to all registered nurses on the CDC's Guidelines for the Prevention of Intravascular Catheter-related Infections. Posters and fact sheets were distributed to the wards.	Primary: Knowledge (survey). Significant improvement after educational intervention. Secondary Adherence & Patient-related nursing outcomes. Adherence showed a significant change in documentation and correct site dressing. No significant change in incidence of phlebitis or extravasation.	Positive	NC

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Lopez, 2011, Australia	Before-After, hospital - Australian Capital Territory hospitals, Single centre, Skin care - Skin tears Before: 1 day audit. Impl: Unclear After; 2 m after baseline audit, 1 day audit	Sample size: Before: *n*=20, After: *n*=15. No further description Sample size: Before: *n*=96 Mean age 78,2 (10.92) 62,5% females After: *n*=95 mean age 78,74 (0.89) 60% females	Pre-audit results were discussed and disseminated to the ward staff. Repeated education workshops including educational material. Each clinical unit was provided with the skin tear prevention management algorithm. Appropriate skin tear dressing materials in the unit were checked and supplied if needed.	Primary: Adherence. 8 criteria measured. No statistical tests performed. Percentage of change ranged from 0% to 78%.	NA	No change

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Lozano, 2004, USA	Cluster Randomized Controlled Trial, Primary care paediatric practices, Multi centre, Asthma treatment Before; 3 m Impl: Unclear After: Unclear Total study period of 2 years	Not specified. Total sample: *n*=638. Usual care: *n*=199 mean age 9,6, 40% girls. Peer leader intervention: *n*=226 mean age 9,3 43% girls. Planned care intervention: *n*=213, mean age 9,4, 38% girls	Peer leader intervention: training 1 physician per site to serve as asthma champion. Including 2 workshops, central support, an ongoing learning network via national and local teleconferences. Several materials, including reference articles, pocket cards and reminders. Planned Care Intervention: Planned asthma care (PAC) visits with a trained asthma nurse constitute the core of this intervention. Asthma nurses were trained in the guideline and in self-management support techniques. In addition to reading the manual, nurses attended a full day training session, learning motivational enhancement, problem-solving, and met weekly or every other week for 10 weeks for 1h conference calls. Usual care: Practices randomized to this arm received a copy of the guideline and a tool kit of patient education materials 1 year into the study.	Primary: Patient-related nursing outcomes: We observed a secular trend (usual care intervention) toward a decrease in asthma symptom days during the study period of 14.8 (95% confidence interval [CI]−22.4 to−7.28) fewer asthma symptom days per year of intervention. Children in the planned care arm experienced an additional reduction of 13.3 (95% CI,−24.7 to−2.1) fewer ASD-14 per year of intervention (p=0.02) relative to children in usual care. This decrease attributable to the planned care intervention represented a 12% reduction (95% CI, 2% to 23%) from the baseline of 107.5 days per year. Children in the peer leader arm experienced 6.5 (95% CI, −16.9 to 3.6) fewer asthma symptom days per year as compared with children in usual care, but this decrease did not attain statistical significance.	NA	No change Positive No change

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Paquay, 2010, Belgium	Before-After, home care - 5 participating home nursing agencies, Multi centre, Skin care - pressure ulcer Before: 1 m, 1 d collection. Impl: unclear, 1 d? After: 6 m, 1 d collection, 2nd After: 18 m, 1 d collection	Home care nurses, not specified Before; *n*=5999. After 6m *n*=5894 After 18 m *n*=6097. 69% women, ~70% between 70 and 90 years of age	Sensitization and education of nurses, making documentation available for nurses. Training on pressure prevention. A leaflet for informing patients and informal caregivers was designed by an interdisciplinary working group of wound care experts and experts in patient teaching (pilot tested). One tissue viability nurse from each regional department attended a conference on BGPDU. These nurses organized training sessions for all nurses. Feedback after the first post-measurement was given by means of an automated information report. Reference nurses were involved in providing feedback and explanation to the regional departments.	Primary: Adherence/adherence. Application of preventive measures and materials, Chi-square showed a significant increase. Secondary: Patient-related nursing outcomes. Less patients had signs of pressure ulcer lesions (Wilcoxon two sample test) and less number of lesions per patient (Wilcoxon two sample test)	Positive	Positive

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Pun, 2005, USA	Before-After, hospital - Intensive Care Unit wards of the VanderBilt University Medical Centre in Nashville and the Veterans Administration Tennessee Valley Healthcare System-York Campus (VUMC resp York-VA), Multi centre, Delirium and sedation VUMC: Before:1 m Impl: 1 w After: 12 m York-VA B: 2 w Impl 1 w After 6 m	Total sample size: *n*=64. VUMC *n*=40. York-VA *n*=24. Mean years of experience 7.4 to 13.9 (VUMC resp. York-VA) Total sample size. *n*=711. VUMC *n*=614 York-VA *n*=97. Mean age 52.5 - 65.9 (VUMC resp. York-VA) Females: 49.7% - 1 % (VUMC resp. York-VA)	Both institutions modified their documentation systems to incorporate the RASS and CAM-ICU into the neurologic assessment of the hourly flow sheet below vital signs. VUMC used a paper documentation system, whereas York-VA used a computerized charting system and inserted both scales into the hourly data record portion, Education began with display of a 3x 3-foot poster containing bulleted concepts about sedation and delirium. A 20-min unit-wide in-service was then attended by all nurses; this included in-depth descriptions of the RASS and CAM-ICU (utilizing bulletin boards, handouts, laminated pocket cards, and case studies), followed by bedside demonstration rounds.	Primary: Adherence. Presented in figures, no statistical test performed. No difference between baseline and after implementation is discussed for adherence Secondary: Experience & patient-related nursing outcomes. Agreement data (bedside nurse and expert reference-standard) No difference between baseline and after implementation is discussed	No change	No change

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Rao, 2009, United Kingdom	Cluster Randomized Controlled Trial, nursing home - 12 nursing homes in and surrounding south London , Multi centre, Infection prevention - Hand hygiene, environmental and disposal hygiene. All stages Unclear. Overall 2-year project	Average sample size per nursing home; Control: *n*=34, of different educational levels. RN *n*=11, Healthcare assistants *n*=20. Temporary staff *n*=3. Intervention: *n*=54 RN *n*=12, Healthcare assistants *n*=41. Temporary staff *n*=1. Average sample size number of residents per nursing home. Control: *n*=38 (median 27 range 19-51). 65% females. Intervention: *n*= 51 (median 49 (23-81) 60% females	Infection control team consisting of a dedicated infection control nurse. Who was supported by a senior nurse specialist in infection control and an infection control doctor. Teaching and training. Providing feedback. Providing personal alcohol-containing gels to improve hygiene. 24-hour telephone support for management in specific infection control problems	Primary: Adherence. No statistical difference found after implementation.	No change	NA

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Reynolds, 2016, USA	Before-After, Hospital - Neuro critical care unit , Single centre, Stroke care Before: Unclear Impl: Unclear After: direct 2nd After: 3 w	Neuro critical care nurses. *n*=88 employed on the unit of interest. No description	Combination of 3 interventions. 1. Local opinion leaders; experts in stroke, were noted by staff and leadership to be informal leaders (consisting of clinical nurse specialist, clinical educator, stroke coordinator, direct care nurses). 2. Printed educational material; availability and streamlining of information (access to packet in each patient room). 3. Educational outreach; one-on-one, face to face educational sessions from the implementation team, with a script for consistency	Primary: Adherence, increase in adherence not significant. Secondary: Knowledge, NIHSS/ neurological and other assessment frequency questions (p=0.000)	No change	NA
Rosen, 2006, USA	Before-After, Nursing home , Single centre, Skin care - pressure ulcer prevention Before: 3 m Impl: 3 m After: 3 m 2nd After: 6 m	Not specified. Total sample: *n*=455 Before: *n*=134. Impl *n*=107. After *n*=107. 2nd After *n*=107.	Ability, Incentives and Management. Ability; Obligated computer-based interactive video education. Incentives: financial incentive in case of success. Management feedback: real-time feedback of Pressure Ulcer incidence weekly updated and posters in non-public staff lounge. Small financial reward ($10) completion of training, this also served to support the staff needing to train during their off hours.	Primary: Patient-related nursing outcomes. Incidence R (incidence of the number of residents developing 1 or more PU's) Incidence P: (incidence of new ulcers per mean number of occupied beds). There was a significant reduction the emergence of stage 1-4 PU's with an incidence-P of 28.3% and 9.3% for the pre-intervention and intervention periods, respectively (p<0.001) For PUs stage 2 and greater, the incidence-R was 15.7% and 9.3% for the pre-intervention and intervention periods (p>0.05). The incidence-P for stage 2 and greater was 23.1% and 9.3% (p<0.05) for the pre-intervention and intervention periods respectively.	NA	Positive

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Savvas, 2014, Australia	Before-After, nursing home - Residential aged care facilities across three Australian states, Multi centre, Pain - Australian Pain Society Before: Unclear Impl: Unclear After: 1 y	Not specified. No description	Several educational sessions. Tailored to specific staff roles. Lectures, workshops (four three-hour sessions) and one-on-one on-the-job training sessions (two half-day sessions). Use of local pain champions, or pain teams (typically staffed by combination of managers, pain champions, and allied health staff)	Primary: Adherence. No statistical test performed. Data shown in table. All facilities showed an increase in adherence. Approached adherence showed significant improvements in approaching the expectations of those standards. Secondary: Staff efficacy. Showed a significant change in questions about pain identification, assessment and management	No change	NA

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Seto, 1991, China	Before-After, hospital - 6 wards, 3 male, 3 female, Single centre, Infection prevention - Catheter associated urinary tract infections Before: 3 w Impl: 1 m After: 1 m, 1-week daily assessments	Nurses, including student nurses. Three groups, total *n*=220. Group A (Opinion leaders and lecture) *n*= 72, staff nurses *n*=45, 83% females. Group B (Opinion leaders - OL) *n*=73, Staff nurses *n*=42, 82% females. Group C (Lecture) *n*=75, staff nurses *n*=47, 81% females No description	Opinion leader and lecture (gr A) Opinion leaders (gr B) Lecture (gr C. Educational outreach: in-service) (30 min provided by infection prevention nurse) to group A & C) and demonstration (tutorials in small groups to group A & B)	Primary: Adherence(measured by survey) there was no difference (p = 0.36) in the scores between group A (OL and lecture group; 5.63) and B (OL group: 4.96) when analysed by ANCOVA. However, the change in mean practice score in group C (lecture group; 3.29) was significantly lower than that of both groups A and B ($p<0.05$, and $p<0.05$, resp.). Secondary: Adherence(measured by observation). The percentage of correct practices in group A, and OL and lecture group (50%) was significantly higher ($p<0.05$) than group C (lecture group; 38%). However, the percentage in group A is also significantly higher ($p<0.05$) than that of group B (OL group; 35%).	Positive Positive No change	NA

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Sipila, 2008, Finland	Before-After, General practices - 31 in total, Multi centre, Early detection, prevention and treatment of CVD (Cardiovascular disease) Unclear. Overall 2-year project	Sample size: Before: Self audit - nurses: *n*=266 After: *n*=233. Before: self-audit - doctors: *n*=140 After: *n*=134. No description	Self-audit, brainstorming, cause/ effect analysis (fishbone) patient cases and open discussions, audit and feedback. Facilitators per site were motivated by a small financial increment on their monthly salary	Primary: Adherence self-reported. Secondary: Patient-related nursing outcomes. No statistical tests performed.	No change	NA
Snelgrove-Clarke, 2015, Canada	RCT, hospital - University affiliated teaching hospital in Atlantic, Single centre, Foetal Health Surveillance Before: 1 m Impl: 6 m After: 1 m	Intervention group before: *n*=44 After: *n*=17. Control before: *n*=45 After: *n*=35. No specific description provided No description	Repeated Action learning meetings. Where enablers and inhibitors were discussed. Action Learning is a facilitative approach that allows for the inclusion of interventions that would align well with the elements proposed in the PARIHS model (Kitson et al. 2008). It is a complex approach that can incorporate participant inclusion, social exchange, and contextual issues; all-important in understanding the pace and complexity of practice change. Risk of contamination, control and experimental were working on the same ward.	Primary: Adherence. Guideline adherence collected as 100% yes, if less; no. No significant change between groups. Secondary: Enablers & Inhibitors. Practice environment, Doppler availability, events during labour, ambulation.	No change	NA

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Tian, 2017, Belgium	Before-After, Hospital, Single centre, Cancer related fatigue Before: 3 m (survey). Impl: 3 m After Unclear	Not specified. *n*=6 university schooled, *n*=10 junior college, *n*=2 technical in group A. In group B respectively *n*=13, *n*=6, *n*=1 & *n*=1 postgraduate. Mean age 31, all females No description	1st a steering group for evidence was composed. Based on baseline survey context evidence and facilitation were targeted items of interest. The steering group formulated proposed changes based on baseline survey. First starting with training on evidence-based nursing for the participating nurses. Using printed material and educational meeting. Using a quality review sheet. Steer group collected feedback periodically. Interventions were targeted on the organisational culture, no specific description available (fig 1).	Primary: Adherence. On Screening/ assessing & intervention (resp. 1-6, 1-5) Secondary: Knowledge and actions of nurses (survey). Surveys for patient experience	No change	NA

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Törmä, 2014, Sweden	Controlled Before-After, Nursing homes - 4, Multi centre, Nutritional Unclear. 18 m between pre and post measurement.	Not specified. 172 participants. 55 in EF, 46 EOV, 71 lost to follow-up. Mean age was 83.8 to 86.5 (EF-EO)	EF: External Facilitator strategy. EO: Education outreach visit. The EF was multifaceted; feedback on baseline characteristics, mealtime observation. encouraging critical inquiry regarding nutritional practices to highlight need for change. meetings every 3-4 weeks for a year. practice audits were performed. such as dietary assessments (internal) and mealtime observations (external). EO a personal visit by trained person to healthcare professionals in their own setting. A three-hour lecture at one occasion regarding operationalized nutritional guidelines. including limited feedback on mealtime observations and clinical measurements of the NH residents.	Primary: Patient-related nursing outcomes. Nutritional variables (weight, BMI, etc.). No significant improvement found. However found significant deteriorations for functional and cognitive status, as well as for the EQ-5D index ($p<0.05$) in the intervention group who received Educational Outreach Visits.	NA	No change Negative
Troglic						

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Van den Boogaard, 2009, Netherlands	Before-After, hospital - Intensive Care Unit (PICU and Intensive Care Unit) in a tertiary hospital , Single centre, Delirium Before: 2 collections in 4 m Impl: 4 m After: 4 m	Not specified. Sample size: Total *n*=1742 Before: *n*=512 mean age 57.5 (16.4) 33.8% females. During *n*=589 mean age 58.9 (16.6) 37.2% females. After: *n*=641 mean age 59.5 (15.6) 36.2% females.	Educational outreach visits, prior a knowledge test, then a 1h group training. Appointment of delirium key-nurses. Supplementary individual training on the job by researcher and the key nurses, whenever the adherence rates dropped. Posters, material to perform assessment was made available. Digital option instead of paper. Reminders and feedback on performance was provided.	Primary: Adherence positive significant change 77% to 92%. Secondary: Adherence: The median dose per patient decreased from 18 mg to 6 mg (p=0.01) Secondary: Patient-related nursing outcomes: the median duration of treatment with haloperidol decreased from five (IQR 2-9) to three days (IQR 1-5) (p=0.02)	Positive	Positive
Van der Putten, 2013, Netherlands	Cluster Randomized Controlled Trial, Nursing homes - Within 100km radius of the centre of the Netherlands, Multi centre, Oral care Before: Unclear Impl: Unclear After 6 m	Not specified. Sample size: Intervention: baseline *n*=177, after *n*=115. Mean age 80.4 (9.4) 66% females. Control: baseline *n*=166 After *n*=117 mean age 80.7 (10.9) 69% females	WOO's (ward nurse acting as ward oral healthcare organizer). Several education sessions, WOO's were trained first and acted as trainers for their own ward. WOO's assisted and encourage nurses. Patients received products and materials as well. Control group received oral care products and materials as well	Primary: Patient-related nursing outcomes. Dental status there was not significantly different between the intervention and the control group. Mean dental and denture plaque was significantly different at 6 months with a bivariate analysis. However, as a result of the multilevel analysis, the reduction of mean dental plaque scores could not be explained exclusively by the intervention.	NA	Positive

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Van Gaal (a), Van Gaal (b), 2011, Netherlands	Cluster Randomized Controlled Trial, Hospital and nursing homes - 1 university hospital. 2 large teaching hospitals, one small hospital and 6 nursing homes. 10 hospital wards + 10 Nursing home wards, Multi centre, Combination of multiple guidelines - Pressure ulcer, urinary tract infection and falls Before: 3 m Impl: 14 m After: 9 m	Not specified. Hospital: Before: Intervention: *n*=346, mean age 66 (14.5), 53.2% females. Usual care: *n*=341 mean age 64 (16.9), 59.8% females. Follow-up: Intervention: *n*=1081 mean age 66 (14.7) 52.7% females. Usual care: *n*=1120 mean age 67 (16.1) 57.7% females. Nursing homes: Baseline: Intervention: *n*=114 mean age 78(9.9) 61.4% females. Usual care: *n*=127 mean age 78 (11.7) 66% females. Follow-up Intervention *n*=196 mean age 80 (10.9) 66.8% females. Usual care *n*=1120 mean age 79 (10.5) 64.3% females	Educational group lessons. A CD-ROM with educational material and knowledge test. Case discussions on every ward. Patient involvement through information folders and oral information by nurses. Feedback; digital feedback based on the computerized registration system.	Primary: Patient-related nursing outcomes, In both hospitals and nursing homes, patients in the intervention groups developed fewer adverse events compared to patients in the usual care groups. Secondary: Adherence PU: No statistically significant difference in patients at risk receiving adequate preventive care was found between the intervention and the usual care group (estimate = 6%, CI: 7–19). Urinary tract infections: Statistically significantly fewer patients at risk in the intervention group received adequate preventive care (estimate = 19%, CI: 17–21). Falls: The numbers were too low for statistical analysis, but it seems obvious that there was no difference between the intervention and the usual care group in adequate preventive care given.	No change	Positive

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Van Lieshout, 2016, Netherlands	Cluster Randomized Controlled Trial, General Practices, Multi centre, Cardiovascular risk management in general practices Before: Unclear Impl: Unclear After: 6 m	General practitioner nurses. Intervention group *n*=20. Mean age 42. Mean years of experience as a nurse 12. Mean number of hours previous training in Motivational Interviewing 14.7. Control group *n*=14. Mean age 43, years of experience 11, number of hours previous MI training 14.8 Intervention: *n*=1250. Mean age 72.6 (9.7) Female 35.1% Control: *n*=979. Mean age 71.6 (9.7) Female 34.9%	Structured feedback on Motivational interviewing skills in practice. Access to online educational program, guidance on relevant eHealth options for patients. A planned twitter consultation hour for patients. Flow chart for dealing with depressive CVD patients. Treating depression before giving any lifestyle advice.	Primary: Adherence. No found effect . Secondary: Patient-related nursing outcomes. Physical exercise RAPA: improved in the intervention group compared to the control group. The RAPA score improved on a scale from 1 to 7 from 4.8 to 4.9; in the control group, the activity diminished reflected in a score diminishing from 4.9 to 4.8 ($p < 0.05$). On the other cardiovascular risk factors assessed (SBP, LDL cholesterol, smoking status, BMI, and diet), the improvement program had no significant effect. We found no difference in the effect of the intervention between the high cardiovascular risk group and the group with established CVD. However, CVD patients had their LDL cholesterol and SBP level more often on target (OR 3.8, 95 % CI 2.9–5.1 and OR 1.5, 95 % CI 1.2–1.8, respectively).	No change	P

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Vander Weg, 2017, USA	Before-After, Hospital - General medical units of four US Department of Veterans Affairs hospitals, Multi centre, Smoking cessation Before: 8 m Impl: 8 m After 6 m 7-day point prevalence of smoking abstinence	Education not specified. Total sample *n*=226. Gr 1 *n*=42. Gr 2 *n*=72. Gr 3 *n*=60. Gr 4 *n*=52 Before: *n*=498. After: *n*=394	Enhanced academic detailing of staff nurses, consisted of face-to-face training of inpatient registered nurses, performance feedback, periodic check-ins with nurse managers and peer leaders. Adaptation of the electronic medical record, patient self-management, and organizational support and feedback.	Primary: Patient-related nursing outcomes , No statistically significant differences in 7- or 30-day PPA(point prevalence abstinence)-rates. Approximately 55–65% of participants reported making at least one quit attempt at the three- and six-month follow-ups, with no statistically significant differences observed across period ((AOR= 1.00; CI95: 0.76–1.34) and (AOR = 1.01; CI95: 0.74–1.35) respectively).	NA	No change

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Ward, 2010, Australia	Cluster Randomized Controlled Trial, nursing home - residential aged care facilities with at least 20 beds, 88 facilities included, Multi centre, Mobility - Preventing falls Before: 7 m Impl: 17 months After: Unclear	Not specified. Total sample: *n*=5391. Control: *n*= 2586, median age 85 (Range: 27-107) 72% females. Intervention: *n*=2807, median age 86 (range: 32-107), 73% females.	The project nurse provided link people from each intervention facility with information and resources to assist with preventing falls and fractures. Intervention facility staff were also invited to attend a workshop to learn how to plan and run exercise programs.	Primary: Patient-related nursing outcomes; Mean number of falls per month, No significant differences between intervention and control groups at commencement, or after. Rates of femoral neck fractures were similar in both groups (p=0.8). There was no difference in rates of fractured neck of femur between intervention and control groups during the 17 months of intervention, and no difference in fracture rates in the entire cohort between the first 6 months of the intervention and the last 6 months. Secondary: Adherence. there were significant increases in the provision of hip protectors and use of vitamin D supplementation in both intervention and control facilities. No difference between control and intervention group.	No change	No change

Author, Year, Country	Design Setting, Single/ Multi centre, Guideline, Duration	Professionals Patients	Short description of implementation strategies	Outcomes measured	Effect on adherence	Effect on patient related nursing outcome
Zhu, 2018, China	Before-After, hospital - Shanghai Public Health Clinical Centre, Single centre, Infection prevention - Non-pharmacological fever management in HIV patients Before: 1 m Impl: 2 m After: 2w	Nurses, no specific description provided. *n*=10 No description *n*=30	Two tailored education programs. Work manuals and educational materials were provided to nurses and patients to raise their knowledge and skills in HIV/ aids-related fever management. Before the project, the content of education materials mainly focused on basic knowledge about HIV/AIDS and strict adherence to antiretroviral therapy. Although these two topics are an indispensable part of education among PLWHs, effective symptom management is a critical skill for both patients and nursing staff. Delivering knowledge on fever and febrile symptom management not only improves patients' quality of life, butis also a viable option to decrease healthcare costs. Consequently, all nurses in the department receiveda training program on fever and febrile symptom management among PLWHs, which improved the patient quality of education.	Primary: Adherence/adherence. Criteria 1 to 7. significant increase (0% before for criteria 1,2,4,5,6,7). (*n*=30) Secondary: Nurses' knowledge. Significantly increased (*n*=10)	Positive	NA

h=hour; d=day; m=month; w=week; y=year; impl=Implementation phase; resp.=respectively; NA=Not applicable; VAP=Ventilation Acquired Pneumonia; BOAS=Beck Oral Assessment Scale; ADL=Activities of Daily Living; ICU=Intensive Care Unit; AF=Audit & Feedback; EO= Educational Outreach; NNT=Number Needed to Treat; VTE= Venous ThromboEmbolism; BPG=Best Practice Guidelines; CRN=Clinical Research Nurse; CDC=Centers for Disease Control and Prevention; WHO=World Health Organisation; CPG=Clinical Practice Guideline; ANNP=Advanced Neonatal Nurse Practitioner; PAC=Planned Asthma Care; VUMC= VanderBilt University Medical Centre; York-VA= Valley Healthcare System-York Campus; RASS= Richmond Agitation and Sedation Scale; CAM-ICU=Confusion Assessment Method for the Intensive Care Unit; NIHSS=National Institutes of Health Stroke Scale; PU=Pressure Ulcer; OL=Opinion Leaders; PARIHS= Promoting Action on Research Implementation in Health Services; EF=External Facilitator Strategy; BMI=Body Mass Index; PICU=Paediatric Intensive Care Unit; WOO's=Ward nurse acting as ward Oral healthcare Organizer; HIV=Human Immunodeficiency Virus; AIDS= acquired immune deficiency syndrome; PLWH=People Living with HIV/AIDS

Supplement 3. Calculations of relative change percentage for the patient-related nursing outcomes

Example 1 De Laat, 2006: Uncontrolled study

Outcome: Frequency of pressure ulcer patients grade I-IV

Results presented in table 3 (De Laat et al., 2006):

Before: 121/657 (18%)

After: 98/735 (13%)

2nd After: 82/755 (11%)

Relative change 1st After: ((13 –18) / 18) * 100 = -27.78%

Relative change 2nd After: ((11-18) / 18) * 100 = -38,89%

Example 2 Van Lieshout, 2016 : Controlled study

Outcome: Physical Exercise (RAPA, 1-7)

Results presented in table 5 (Van Lieshout et al., 2016):

Time	Baseline	Follow-up
Intervention	4.8	4.9
Control	4.9	4.8

Relative change Intervention (RCI): ((4.9 – 4.8) / 4.8) * 100 = 2.08

Relative change Control (RCC): ((4.8 – 4.9) / 4.9) * 100 = -2.04

Relative change: (RCI)/(RCC) = 2.08/-2.04 = -1.02

Supplement 4. Cochrane risk of bias for controlled studies

Table 5. Cochrane risk of bias for controlled studies

Author	Year	Randomization	Allocation concealment	Baseline measurement simular	Baseline characteristicesimular	Incomplete oucome data	Blinding	Contamination	Selective reporting	Other	Guideline
Van Lieshout	2016	low	low	low	low	low	low	low	low	low	Cardiovascular risk management in general practices
Van Gaal(a,b)	2011	unclear	low	low	low	unclear	low	low	low	low	Combination of multiple guidelines - Pressure ulcer, urinary tract infection and falls
Snelgrove-Clarke	2015	low	high	low	high	unclear	low	high	low	unclear	Foetal Health Surveillance
Huis	2013	low	low	high	unclear	low	low	low	low	low	Infection prevention - hand hygiene
Rao	2009	unclear	low	high	low	low	low	low	low	low	Infection prevention - Hand hygiene, environmental and disposal hygiene.
Lozano	2004	unclear	low	low	low	unclear	high	low	low		Mobility - Use of physical restraints
Törmä	2014	high	high	low	low	high	high	low	low	unclear	Nutritional
De Visschere	2012	unclear	low	low	low	unclear	low	low	low	unclear	Oral care
Van der Putten	2013	unclear	low	low	low	low	low	low	low	unclear	Oral care
Abraham	2019	low	low	low	low	low	low	low	low	low	Pain - Paediatric pain
Beeckman	2013	low	low	low	low	unclear	high	high	low	low	Skin care - pressure ulcer care

Author	Year	Randomization	Allocation concealment	Baseline measurement simular	Baseline characteristicesimular	Incomplete oucome data	Blinding	Contamination	Selective reporting	Other	Guideline
Ward	2010	low	low	low	low	low	high	low	low	unclear	Skin care - pressure ulcer prevention
Köpke	2012	low	low	low	low	low	low	low	low	low	Stroke care
Gomarverdi	2019	unclear	low	low	low	high	low	low	high	unclear	Stroke care
Cheater	2006	low	low	low	low	unclear	low	low	low	low	Urinary incontinence

Randomization Low risk if randomization method is described
Allocation concealment Low risk if unit of allocation was by team/institution OR by patient with some kind of randomization method
Baseline measurement similar Low risk if baseline measurements were performed and no important difference present across groups OR imbalanced but appropriate adjusted
Baseline characteristics similar Low risk if characteristics were reported and similar
Incomplete outcome data Low risk if missing outcomes were unlikely to bias the results
Blinding Low risk if the authors stated blind assessment OR objective outcomes.
Contamination Low risk if allocation was by team/ institution/practice and unlikely control group received intervention
Selective reporting Low risk if there is no evidence that outcomes were selectively reported
Other Low risk if there is no evidence of other risk of bias

Supplement 5. Risk of bias before-after studies – Newcastle-Ottawa Quality Assessment

Table 6. Risk of bias before-after studies - Newcastle-Ottawa Quality Assessment

Author	Year	Selection	Comparability	Outcome	Overall	Guideline
Jolliffe	2019	2	0	2	Poor	Asthma treatment
Clark	2001	2	0	1	Poor	Blood transfusion
Tian	2017	1	0	0	Poor	Cancer related fatigue
Edwards	2007	3	0	2	Poor	Combination of multiple guidelines - Asthma, breastfeeding, delirium-dementia-depression, smoking cessation, venous leg ulcers, diabetes
Downey	2015	3	0	1	Poor	Crushing medication in case of Tube feeding only
Van den Boogaard	2009	4	0	2	Poor	Delirium
Pun	2005	3	0	1	Poor	Delirium and sedation
Sipila	2008	2	0	0	Poor	Early detection, prevention and treatment of Cardiovascular disease
Ames	2011	3	1	2	Good	Infection prevention - Prevention of Ventilation Acquired Pneumonia
Kingsnorth	2015	3	0	3	Poor	Infection prevention - Catheter associated urinary tract infections
Zhu	2018	1	0	0	Poor	Infection prevention - Non-pharmacological fever management in HIV patients
Cabilan	2014	3	0	1	Poor	Infection prevention - Peripheral cannula infections
Frigerio	2012	3	1	0	Poor	Infection prevention - Peripheral venous catheter management
Duff	2013	4	0	1	Poor	Infection prevention - Standard precautions in Intensive Care Unit
Seto	1991	4	0	1	Poor	Mobility - physical restraint use
Rosen	2006	2	0	3	Poor	Mobility - Preventing falls
Lockwood	2018	3	1	2	Good	Mobility - Venous - thromboembolism prevention programme
Cahill	2014	3	0	1	Poor	Nutritional - Enteral nutrition in the Intensive Care Unit

Johnson	2017	4	1	2	Good	Nutritional - improve nutrition and growth of preterm infants in neonatal intensive care.
Giugliani	2010	3	0	0	Poor	Nutritional - Malnutrition care in rural Africa
Lopez	2004	2	0	1	Poor	Nutritional - nutrition support in mechanically ventilated, critically ill adult patients.
Savvas	2014	1	0	1	Poor	Pain - Australian Pain Society
Dulko	2010	3	0	2	Poor	Pain - cancer related
Choi	2014	3	0	2	Poor	Pain - cancer related
Habich	2012	3	0	2	Poor	Pain - Paediatric pain assessment and management guidelines
Featherston	2018	2	0	1	Poor	Paediatric mental healthcare
Jagt-van Kampen	2015	2	0	2	Poor	Paediatric palliative care
Bjartmaz	2017	4	0	2	Poor	Prevention of venous thromboembolism
Bale	2004	2	0	0	Poor	Skin care
Harrison	2005	4	0	2	Poor	Skin care - Leg ulcers
De Laat	2006	3	0	3	Poor	Skin care - pressure ulcer
Paquay	2010	2	1	2	Fair	Skin care - pressure ulcer
De Laat	2007	3	1	1	Poor	Skin care - pressure ulcer
Koh	2018	3	0	2	Poor	Skin care - pressure ulcer prevention
Lopez	2011	4	0	2	Poor	Skin care - Skin tears
Vander Weg	2017	2	1	2	Fair	Smoking cessation
Reynolds	2016	2	0	1	Poor	Stroke care

Selection: 1.Representativeness of the exposed cohort (truly or somewhat representative score 1). 2. Selection of the non-exposed cohort (drawn from the same cohort score 1). 3. Ascertainment of exposure (secure record and structured interview score 1). 4. Demonstration that outcome of interested wat not present at start of the study (yes scores 1). Maximum 4
Comparability: Study controls for age, sex (scores 1) or other factors to increase comparability (scores 1) Maximum 2
Outcome; 1. Blinding of outcome (independent blind assessment and secure record scores 1). 2. Follow-up was >3 months scores 1. 3. Adequacy of follow-up (complete follow-up or lost to follow up unlikely to introduce bias or number lost less than or equal to 20% scores 1. Maximum 3
Overall: Good; Selection 3 or 4, Comparability 1 or 2, Outcome 2 or 3, Fair; Selection 2, Comparability 1 or 2 , Outcome 2 or 3, Poor; Selection 0 or 1, Comparability 0 , Outcome 0 or 1

Supplement 6. Relative change percentage in the controlled studies on the patient-related nursing outcomes

First author	Year	Design	Guideline topic	After 1 in months	After 2 in months	Delivery Arrangements	Financial Arrangements	Government Arrangements	Implemenation Strategies	Total EPOC	Outcome	Relative Change Percentage Controlled studies	Relative Change Percentage Controlled studies 2nd After	Report-ed a significant change in clinical outcomes
Beeckman	2013	controlled	Skin care	3		2	0	0	9	11	Pressure ulcers (I-IV). *	-7,44	2,71	yes
Van Lieshout	2016	controlled	Other – Cardiovas-cular risk manage-ment in general practices	6		1	0	0	6	7	Physical exercise (Rapid assessment of physical activity RAPA. 1-7). *	-1,02		yes
Van Gaal	2011	controlled	Combi-nation of multiple guidelines	9		0	0	0	8	8	Incidence rate of Adverse events per patient week in hospital	-2,67		yes
De Visschere	2012	controlled	Oral care	6		1	0	0	7	8	Mean tongue plaque	0,66		yes
Van der Putten	2013	controlled	Oral care	6		1	0	0	6	7	Denture plaque	3,29		yes

Köpke	2012	controlled	Mobility	3	6	0	0	0	11	11	Residents with any physical restraint %	73,83	5,76	yes
Cheater	2006	controlled	Other – Urinary inconti-nence	6		0	0	0	6	6	Severity of UI (percent-age with improved outcome). *	1,16		no
Törmä	2014	controlled	Nutritional	0		0	0	0	4	4	MNA-SF Mean. I	1		no
Abraham	2019	controlled	Mobility	6	12	1	0	0	8	9	Mean prevalence of residents with any physical restraint	-1,94	2,52	no
Ward	2010	controlled	Mobility			0	0	0	3	3	Mean no falls per month	83,33		no

* Secondary outcome in this study.
I No specific primary clinical outcome provided. Chose the Mini Nutritional Assessment- Short Form (MNA-SF) mentioned in abstract. Two intervention groups. No control. To calculate relative change EOV functioned as control.

Supplement 7. Relative change percentage in the before-after studies on the patient-related nursing outcomes

First author	Year	Design	Guideline topic	After 1 in months	After 2 in months	After 3 in months	Delivery Arrangements	Financial Arrangements	Government Arrangements	Implemenation Strategies	Total EPOC sstrategies	Outcome	Relative change percentage (%) Before - 1st After (A negative percentage indicates a decrease)	Relative change percentage (%) Before - 2nd After	Relative Change Percentage (%) Before 3rd After	Reported a significant change in patient related nursing outcomes
Ames	2011	before-after	Oral care	14		1	0	0	4	5		Beck Oral Assessment scale over time (day 1,3 and 5)	-22,12			yes
Tian	2017	before-after	Other – Cancer related fatigue			0	0	0	6	6		Patients' scores of CRF self-management scale pre- and post-implementation	NA[k]			yes
Bale	2004	before-after	Skin care			0	0	0	6	6		Severity of incontinence dermatitis (severe, mild and moderate)	-81,42			yes
De Laat	2006	before-after	Skin care	0	11	1	0	0	3	3		Pressure ulcer frequency (grade I-IV) *	-27,78	-38,89		yes
Paquay	2010	before-after	Skin care	6	18	0	0	0	6	6		Most severe skin condition per subject: Blanchable erythema (%) *	-8,7	-23,91		yes

Dulko	2010	before-after	Pain			0	0	0	3	3	Change in worst pain from admission to discharge	3,85			yes
Lopez	2004	before-after	Nutritional	3		1	0	0	4	5	Incidence of extravasation in percentage.*	-100			yes
De Laat	2007	before-after	Skin care	6	15	1	0	0	6	7	Pressure ulcer grade II-IV incidence density	-14,81	-40,74		yes
Giugliani	2010	before-after	Nutritional			0	0	0	3	3	Successful treatment in percentage (Defined as: weight-for-height Z score of more than −2 or ≥80% of NCHS reference median)	12,84			yes
Johnson	2017	before-after	Nutritional	6		1	0	0	6	7	Mean Daily Energy intake (kcal/kg/day) [y]	0,87	1,74	5,22	yes
Van den Boogaard	2009	before-after	Delirium	4		1	0	0	7	8	Number of delirious patients (%) (Because of better screening)*	130			yes
Harrison	2005	before-after	Skin care	12		0	0	0	3	3	Healing rates from venous deseas. *	157,46			yes
Rosen	2006	before-after	Skin care	3	3	0	1	1	6	8	Total pressure ulcers. *	-73,68	-50	-50	yes
Kingsnorth	2015	before-after	Pain	12	24	0	0	0	8	8	Mean pain score for each client (NRS). [u]	-14,79	-82,75		yes

Trogrlic	2019	before-after	Delirium	4	4		1	0	0	12	13	Mean Delirium Duration.*	-48,21	-41,07	yes
Vander Weg	2017	before-after	Other – Smoking cessation	0			2	1	0	9	12	Seven day point prevalence abstinence of smoking	-18,06	-6,45	no
Cahill	2014	before-after	Nutritional	6			0	0	0	5	5	Adequacy of calories from total nutrition (%)	5,41		no
Lockwood	2018	before-after	Mobility				1	0	0	4	5	Diagnosis of VTE (Venous tromboembolism).*	-4,59		no
Lopez	2011	before-after	Skin care	2			1	0	0	7	7	Hospital acquired skin tear prevalence	-100		Unclear
Koh	2018	before-after	Skin care	3	9	16	1	0	0	7	8	Heel PU incidence in Orthopedic wards.*	-42,92		Unclear

* Secondary outcome in this study.
[k] Tian did not provide sufficient data to calculate the relative change percentage for their patient-related nursing outcomes
[y] Results from figure only. Unadjusted and adjusted data were similar. unadjusted data were used to calculate relative change percentage
[u] One of plenty primary outcomes. A lot of missing values