### Search results for 2019 International Pressure Injury Guideline: Health professional education


#### Identified in pressure injury searches
- **n=11,177**

#### Identified citations
- **n=3,085**

#### Excluded after screening title/abstract
- Duplicate citations
- Included in previous guideline
- Not related to pressure injuries
- **n=8,128**

#### Identified in topic-specific key word searches for full text review and critical appraisal
- **n=109**

#### Excluded based on key word searches
- Not related to the topic-specific questions
- **n=2,969**

#### Identified as providing direct or indirect evidence related to topic and critically appraised
- **n=7**

#### Excluded after review of full text
- Not related to pressure injuries
- Not related to the clinical questions
- Citation type/research design not meeting inclusion criteria
- Non-English citation with abstract indicating not unique research for translation
- **n=102**

#### Additional citations
- Identified by working group members
- **n=36**

#### Additional citations
- Appraised for previous editions
- **n=3**

#### Total references providing direct or indirect evidence related to topic
- **n=10**

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# Health Professional Education: data extraction and appraisals

## Articles Reviewed for International Pressure Injury Guideline

The research has been reviewed across three editions of the guideline. The terms pressure ulcer and pressure injury are used interchangeably in this document and abbreviated to PU/PI. Tables have not been professionally edited. Tables include papers with relevant direct and indirect evidence that were considered for inclusion in the guideline. The tables are provided as a background resource and are not for reproduction.


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| • Clinical question 2: What interventions/programs are effective in attaining sustained improvements in health professional knowledge of pressure injury prevention and treatment?  
• Clinical question 3: What interventions/programs are effective in attaining sustained improvements in health professional competency in pressure injury prevention and treatment? |

### Education Programs

**Price, Kennedy, Rando, Dyer, & Boylan, 2017**

- Pre test/post test exploring effect of education intervention on wound prevalence
- Participants were clinical staff recruited in two aged care facilities (n=164)
  - RNs (n= 25, including 12 champions),
  - ENs (n=41) a PCWs (n=98)
- Participants were in two groups: multi-faceted educational intervention consisting of:
  - nurses and personal care staff access to wound expert
  - education sessions addressing needs informed by the pre-test education results (held separately for nurses and personal carers
  - wound book for nurses and pamphlets for care workers
  - online education
  - training in prevalence surveys
- Knowledge test (unknown which test was used) conducted prior to education initiative and after 12 months of intervention
- Diary of staff activities
- **pressure injury prevalence**  
  - Significant reduction in pressure injuries (12.5% vs 6.8%, P=0.01)

**Change in task performance**

- Personal care workers had significant increase in time spent on wound prevention and care (p<0.001)
- PCWs had significant increase in time spent repositioning (p<0.05)
- ENs had significant increase in time spent on wound prevention and care (p=0.001)
- PCWs had significant increase in time spent repositioning (from 1.7mins/shift to 46mins/shift, p<0.001)
- RNs spent significantly more time on risk assessment (p=0.02)
- Pressure injury prevention plans increased from 92% of at risk residents to 95% of at risk residents, p=ns

- Non-validated diary collection of tasks performed was maintained by participants
- Unclear whether the knowledge test was valid and reliable
- Unclear if resident population was similar in both phases
- Uncertain if other factors changed (e.g. type of support surfaces used)

**Level of evidence: 2**

**Quality: Low**
### Health Professional Education: data extraction and appraisals

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| Esche, Warren, Woods, Jesada, & Iliuta, 2015 | Quasi experiment comparing two types PU education delivery on knowledge levels and behavior | Convenience sample of registered nurses (RNs) recruited from 4 acute care units in a community teaching hospital in US (n=141 commenced, n=43 completed) | Participants were randomized at the unit level to receive:  
- Computer based learning module developed by an external healthcare organization covering risk factors, skin anatomy, preventive strategies and classification taking 3-4 hours (CBL, 2 critical care units, n=8 completed)  
- Traditional classroom learning - face-face teaching of the content included in the computer course taking 2 hours (TCL, 2 critical care units) | Demographics including preferred learning style  
- 25 question knowledge test (non-validated) administered pre education (baseline), immediately following education (time 2), 3 months (time 3) and 6 months (time 4)  
- Valid and reliable program evaluation instrument  
- Chart review of PU documentation conducted at baseline, 3 and 6 months following education |  
- Significant increase in risk assessments (p=0.03)  
- Knowledge  
- Enrolled nurses and registered nurses showed significant increase in mean knowledge scores over 12 months (p<0.01 for both)  
- Personal care worked had no change in knowledge scores (p=0.30).  
- Pressure injuries  
- No significant difference in prevalence of PUs between groups (computer based learning 10.5% versus 9.2%, p=0.654)  
- Assignment vs preference  
- More in the CBL group were assigned to their preferred education method compared to TCL group (41.9% vs 25%, p=0.00)  
- Knowledge  
- Compared to pretest, both groups had significantly improved knowledge scores at all posttests (p=0.01) with no statistically sig differences from time 2 to time 3 or 4 between time 3 and 4  
- Mean scores were higher for TCL compared with CBL (TCL 73.3 vs CBL 79.5, p=0.013) at Time 2  
- No significant difference between groups at 3 or 6 months post intervention |  
| | | Inclusion and exclusion criteria not reported | | | Power analysis indicated 70 participants per arm (n=140 total) required – this was not met due to very high attrition (no ITT analysis)  
| | | Characteristics:  
- Mean age: 38.6 years (range 21 to 69)  
- Mean years in nursing: 9.9yrs (range 1 to 18)  
- Associate degree or diploma 56.7%, bachelor’s degree 42%, master’s degree 3.3%  
- Preference for online learning 62.7% | | | Non validated knowledge test was used  
| | | | | | Unclear if groups were comparable at baseline for education level | | | | | | Level of Evidence: 2  
<p>| | | | | | Quality: Low | | | | | | © EPUAP/NPIAP/PPPIA |</p>
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| Feng, Li, Xu, & Ju, 2016 | Develop an educational program to increase knowledge of pressure injuries, improve its management and reduce incidence | Participants were primarily nurses working in OR and emergency in a hospital in China (initial questionnaire: n= 280 potential respondents, n= 275 participants; training program for liaison officers n= 38; after training questionnaire, n= 312 participants; Braden Scale Initial Questionnaire n = 98 participants, Braden Scale Final Quest n = 82 participants) | Educational Program  
- Steering committee took leadership  
- Training was given to liaison officers to lead education  
- Training modules offered  
- Standardized practices for risk assessment, reporting, consultation and treatment were developed  
- International wound expert providing education weekly  
- Knowledge contest | Outcome measures not clear, concerning questionnaire answers and interview content  
- two tests baseline pre-test, before training and a post-test two years after training  
Braden Scale Awareness Classification/Staging system < not specified  
Follow up period: 2 years | Pressure injury incidence  
Knowledge intervention was associated with a decrease in pressure injuries (year 1 occurrence rate across hospital 0.07% versus year two occurrence rate 0.03%)  
Knowledge changes  
Questionnaire score improved significantly (pre-test 47% versus post-test 81%, p<0.001)  
Practice changes  
Use of Braden Scale improved significantly (pre-test 60.02±22.9 versus post-test 88.02±9.0, p<0.001) | Intervention was facility-wide and included medicine, surgery and emergency departments  
Non-validated questionnaire  
Unstated staging system  
Findings not based on the results presented (bias) |
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| Ekama Ilesanmi & Morohunfoluwa Oluwatosisan, 2016 | A pre test/post test study exploring the effectiveness of an education program on knowledge retention. | Participants a self-selected sample of nurses recruited in 3 teaching hospitals in Nigeria (n=193)  
Participant characteristics:  
- 68% registered nurses, 13.5% had a bachelor of nursing science, 16.6% had a Bachelor of education, 1% had a Master’s degree.  
- The intervention group has significantly more experience in nursing (p=0.03) | Participants were randomized at the hospital level to prevent inadvertent spread of information.  
- Intervention group received a 5 day (4 hours per day) workshop of face-face didactic training sessions with visual presentations, small group discussion, brainstorming.  
- Participants were organized in “ward groups” to facilitate team building. At the conclusion participants received written transcript of the material (n=127)  
- Control group received a 4 hour facilitated discussion on usual PU prevention practices and the written transcript of material (n=66) | Pressure Ulcer Knowledge Test (PUKT) consisting of 47 items applied at in examination conditions at baseline, at conclusion of training and at 12 weeks. PUKT has been previously tested for reliability and validity (alpha = 0.82 in this study).  
- Knowledge score results:  
  - There was no significant difference in mean score between intervention group (mean 32.5±42) and control group (mean 30.8±5.0) at baseline  
  - Post education:  
    - The intervention group had a significant improvement in knowledge scores immediately post education (mean 40.7±3.4, p<0.001) and the control group had no significant change (mean 31.2, SD 5.2, p=ns) in knowledge score  
  - Retention score (12 weeks):  
    - The intervention group had a further increase in knowledge at 3 months (mean 42.7±4.0, p<0.001) and the control group also had a significant increase from post-education (mean 37.8±6.3, p<0.001)  
    - Improvement in intervention group was greater, with intervention accounting for 38.5% of change in scores | Knowledge score results  
- Minimal data given regarding participant background and experience in managing PU  
- No detail on recruitment strategies – self-selecting participants may have more motivation or baseline knowledge  
- No exploration of the impact on PU rates | Indirect (PU not an outcome measure) |
| Lopez et al., 2017 | Pretest/post test exploring impact of a computer- | Experiment conducted in three internal medicine units in Spain  
Pre test audit (n=65 records)  
Post test audit (n=57 records) | Specific training program administered to 197 nurses: theoretical and  
- assessed pre- and post-training by evaluating records of PU documentation | Competency  
- Documentation of pressure injury diameter increased from 23% to 40% (p<0.001) | Data Tables: 2019 Guideline Update: Health Professional Education © EPUAP/NPIAP/PPPIA Page 5
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<td>Hofoss, Berg, &amp; Gunning, 2016</td>
<td>Based program on competency in documentation</td>
<td>Inclusion of audit records: Patients admitted for &gt;48 hours Exclusion of venous, arterial and stage I PUs</td>
<td>Practical training session computer based learning with simulation pressure injury assessment web based resources</td>
<td>Pre audit period was records over a 3 month period Post audit was for 3 months, commencing 6 months after the first period variables were ulcer type, location, stage, length and diameter, perilesional skin, products used number of actions taken in the records in correlation to the days of hospitalization nurse satisfaction survey</td>
<td>Documentation of pressure injury length increased from 11% to 38% (p=0.001) Documentation of perilesional skin condition increased from 57% to 79% (p=0.04) PU assessment was updated more frequently in post period (p&lt;0.001) No significant improvement in documenting treatment and products Nurse satisfaction Nurses' level of satisfaction with the training activity showed average score of 8.84 over 10.</td>
<td>Necessarily match practice Small number of records audited</td>
<td>Low</td>
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<td>Bredesen, Bjoro, Gunnberg, &amp; Hofoss, 2016</td>
<td>Develop and test an e-learning program for assessment of pressure ulcer risk and pressure ulcer classification</td>
<td>Participants were recruited in two hospitals and four nursing homes in Norway (n=18) • Participant characteristics: 97.7% female 81.8% worked in hospital setting Work experience ranged from 0-32 years Over half had 6 or more years work experience &gt;10% had post graduate specialization No significant difference with participant characteristics</td>
<td>Intervention: E-learning program Two training programs: one for use of Braden Scale and another for PU classification based on NPUAP 2014. Control: Classroom lecture training three tests baseline pre-test, before training, a post-test immediately after training and a three month follow up test. 2 training programs: one for use of Braden Scale and another for PU classification based on NPUAP 2014.</td>
<td>Three tests baseline pre-test, before training, a post-test immediately after training and a three month follow up test. The outcome measures were the number of correct Braden subscale scores of patient cases and the number of PU photos correctly classified before and after training as compared to predetermined correct answers based on expert opinion Classification of pressure injuries pre-training No significant difference was found for Braden subscale score in any of the 3 tests. Fleiss Kappa range 0.05 – 0.59 Classification of pressure injuries post-training In immediate post training test the intervention group (e-learning) scored significantly higher than control on all categories except for staging pressure injury Category/Stage IV (when comparing the same photo set p = .006). Fleiss kappa for each photo set ranges from 0.13 to 0.29) The author found equal or better results for the e-learning program compared to classroom lectures. An e-learning program may be more efficient as can be applied to real patients</td>
<td>Very small numbers No power calculation performed prior to study Participants completing post tests may have been more interested in PIs than drop outs Photos were used instead of real patients Training programs were in Norwegian</td>
<td>Indirect (PU not an outcome measure)</td>
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| Morente, Morales-Asencio, & Veredas, 2014 | RCT evaluating the effectiveness of an e-learning technology for PU training | Participants were recruited in Bachelor of Nursing program in a university in Spain (n=73)  
Inclusion criteria:  
- enrolled in the ‘Nursing for Adult I’ course  
- Exclusion criteria:  
- previous clinical or educational experience in pressure injuries  
- Participant characteristics:  
- No significant difference with participant characteristics  
- aged 18-48 years old (no differences between groups)  
- Primarily females  
Intervention: E-learning program  
1 training program for PU assessment (n=30)  
Online education program designed for undergraduates designed to improve decision-making regarding pressure injury wounds and promote active learning  
Control: Classroom lecture training  
1 training program for PU assessment (n=40 commenced, n=1 lost to follow up) | two knowledge test tests baseline pre-test, before training and a post-test immediately after training using a non-validated tool  
The outcome measures were the number of correct answers after observing each photo before and after training as compared to predetermined correct answers based on expert opinion  
Pre-test results  
no significant difference between groups for the pre-test; average total score of 8.27 (SD1.39) for experimental versus control 8.23 (SD 1.23).  
post-test:  
the average total score of the experimental group was 15.83 which was significantly higher (p<0.01) than that obtained from the control group (11.6).  
The author found equal or better results for the e-learning program compared to classroom lectures. An e-learning tool improves the educational efficacy of the training process. | be done at nurse’s convenience and can be repeated until proficiency achieved. | • High dropout rate in both groups of 59%  
Indirect evidence (PU not an outcome)  
Quality: Low  
Note this study does not have a measure to demonstrate sustained results |
| Wogamon, 2016 | Pretest/posttest QI project to explore effect of CNA education in care facility for adults 55 and over on pressure injury incidence | Participants were recruited in aged care in US (n=33)  
Inclusion criteria:  
full and part time CNAs (English and bilingual) working in a short stay facility  
Exclusion criteria (not defined)  
Participants:  
- Primarily aged 18-29 range (52.61%)  
- Primarily Caucasian (45.16%)  
All CNAs were required to attend in-service education (PPT) for pressure ulcer prevention, cause and risk of developing pressure ulcers, staging of pressure ulcers, positioning patients to decrease risk, documentation and reporting.  
Education was based on NPUAP guidelines  
Anonymous surveys administered before, immediately after, and 3 months later  
Demographic questions: age, years of experience, PU prevention training “Initial CNA training” or “on the job”  
Pressure ulcer Incidence data in Medicare Nursing home Compare Quality Measures, before and 3 months after intervention was | Pressure injuries  
Reduction in pressure ulcers (12.3% before intervention to 0% post intervention)  
Reporting of skin breakdown  
CNAs reporting of skin breakdown increased by 68 % (8 reports to 17)  
Education Scores  
Education did not significantly improve knowledge scores (p=0.5387) | | • Pressure injury incidence varies based on resident risk variability of facility.  
None of these variables were controlled  
small sample size.  
Unclear who measured prevalence and Level of evidence: 2  
Quality: Low  
QI reporting standard: High
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<td>Tweed &amp; Tweed, 2008</td>
<td>Longitudinal repeated measures design investigating effectiveness of an education program in improving knowledge of ICU nurses</td>
<td>Participants recruited from a 12-bed ICU in a teaching hospital in New Zealand (n=62) Inclusion: all nursing staff in unit Baseline characteristics: 27% RN2 level, 4% RN4 (most senior and 1% RN1 (most junior) 39% graduated in 1990s 55% had a nursing diploma or degree, 10% had postgraduate qualifications Mean time in ICU 83 months 53% no additional education on PU</td>
<td>• Educations program based on the Australian Wound Management Association guidelines for prediction and prevention of PU delivered in small groups over 2 week period  • Interactive format based on oral presentation with 112 slides  • 3 hours session  • Key areas include guideline methods, PU epidemiology, aetiology, pathophysiology, risk factors, risk assessment, staging, equipment for prevention, documentation</td>
<td>Knowledge level at baseline, within 2 weeks of an educational program and Knowledge test designed with input from EUPAP members using a modified Delphi technique consisting of 11 multiple choice and short answer questions piloted in a step-down unit at 20 weeks.</td>
<td>Conclusions: Rate of pressure injury development was lower and documentation of skin assessment and interventions were higher after the intervention</td>
<td>the methods used  • Unclear if patient samples were similar for the pre and post education prevalence survey</td>
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<td>Kwong, Lau, Lee, &amp; Kwan, 2011</td>
<td>pretest/post-test investigating a focused</td>
<td>Participants were recruited from a government-subsidised nursing home in Hong Kong (n=52)</td>
<td>The PU prevention program for nursing homes program that included training and a knowledge assessment with an adapted version of the validated Pieper and Mott’s knowledge test that</td>
<td>Knowledge assessment</td>
<td>Knowledge skills  • There was a significant increase in the knowledge and skills of NLCPs  • Mean score at baseline (n=62) 84%  • Mean score at 2 weeks (n=38) 89%, (p=0.003 versus baseline).  • Mean score 20 week (n=29) 85% (p=ns versus baseline)  • No association between years of qualification, length of time in the ICU or self-reported additional PU education and test scores at any time point  • Study conclusions: ICU had a strong baseline knowledge of PUs and this improved for a short period after a structured PU education session. Improvements in knowledge were not sustained at 5 months post-education.</td>
<td>Use of 3 different tests may have accounted for differences in the scores.  • Baseline tests were observed while the participant was taking the test, but not the 2 or 20 week tests  • Use of nurses drawn from a single ICU  • Possible that knowledge improvement only occurred in those who already had a high knowledge  • Indirect evidence: no association made between knowledge and PU outcomes</td>
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| **training course for PU prevention** | Inclusion/Exclusion criteria: not reported | Characteristics:  
- Non-licensed care providers (NLCPs)(n=41) and nurses (n=11) | evidence-based prevention protocol  
The focused training course involved:  
- 2 hour lecture  
- 4 hours of skills training (turning, positioning, lifting, transfers, device use, skin and risk assessment  
- training in etiology, assessment, risk factors, risk assessment, evidence-based interventions) | had been translated to Chinese  
- Pressure ulcer rates (no description of a staging system) but all PUs reported on discovery and verified by a researcher  
- Data collection points: (prevalence and incidence only)  
- Before commencement (n=41, only NLCPs)  
- After completion of skills training (n=41)  
- 6 weeks post training (n=29, 71%)  
- 12 weeks (prevalence and incidence only) | immediately after intervention compared with baseline  
- knowledge: $\chi^2=33.67, df=2, p=0.001$  
- skills: $\chi^2=19.517, df=2, p=0.001$  
- At 6 weeks, there was a significant increase in the knowledge(p<0.001) and skills (p=0.001) of NLCPs compared with baseline  
- Six week knowledge scores were significantly lower than those immediately after the intervention (p=0.001)  
**PU incidence**  
- baseline 2.5%  
- 0 to 6 weeks 2.4%  
- 6 to 12 weeks 0.8%  
- 6 weeks 3.3%  
- 12 weeks 2.5%  
-工具 as a framework for skill and knowledge assessments  
- Possible Hawthorne effect  
- PU rates before the intervention were unknown  
- Patients assessed at each time point may not have been the same workers were involved in training but only assessed knowledge of unlicensed workers  
- Unclear if matched samples were used for skill and knowledge assessments  
- Possible Hawthorne effect  
- PU rates before the intervention were unknown  
- Patients assessed at each time point may not have been the same workers were involved in training but only assessed knowledge of unlicensed workers  
- Unclear if matched samples were used for skill and knowledge assessments  
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- Unclear if matched samples were used for skill and knowledge assessments  
- Possible Hawthorne effect  
- PU rates before the intervention were unknown  
- Patients assessed at each time point may not have been the same |
| **Thomas, 2012** | pretest/post-test investigating a focused training course for PU knowledge and documentation improvement | Participants were a convenience sample recruited from 4 units in one US long term care facility (n = 10) |  
- All aged > 35 years  
- 7/10 had a diploma, 1 had a bachelors degree and 2 had other qualifications  
- 80% had >2 years’ experience  
- 50% had >10 years’ experience | The PU education consisted of two sessions held one month apart. The sessions included evidence-based information on assessment, prevention, offloading devices, treatment options and documentation strategies.  
- Knowledge assessed using 15 multiple and true/false statements. Tests administered:  
- Pre-education session 1  
- Post education session 1  
- Pre education session 2  
- Post education session 2  
- Audit of nursing documentation using the PUSH tool as a framework conducted:  
- Pre-education session 1 | Pre test knowledge  
- mean score 63.2 (SD 17.23)  
- 50 patient wounds documented  
- Post test 1  
- mean score 80.2 (SD 8.53)  
- 61 patient wounds documented  
- Documentation of wound size, exudate and tissue type improved, documentation of interventions did not improve  
- Pre test 2  
- mean score 73.80 (SD 11.39) | Smaller standard deviations indicate increase in similarity of responses that could account for the increased mean  
- Very small sample, unlikely to be adequately powered  
- Non-validated data collection  
- Indirect evidence: association made between knowledge and PU outcomes is not formally measured and reported |
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| Jill Cox, Roche, & Van Wynen, 2011 | Pre/post-test study comparing didactic learning to computer-based learning for retention of PU knowledge | A convenience sample of staff nurses (RN) in a teaching hospital in USA (n=60, n=32 were in ICU) | Education was delivered via PowerPoint in a 1.5 hour session. | Post test 2  
- mean score 92.3 (SD 6.13)  
- Knowledge increased by 30% versus baseline  
- 51 patient wounds documented  
- documentation of wound size, exudate and tissue type improved 20% from baseline | Nurses were administered the Pieper Pressure Ulcer Knowledge Test (47 items) for which previous validation is reported  
- Measures at baseline, post-test, 3 months and 6 months |  |
|  | Characteristics: | | | | |  |
|  | 57% aged > 40 years  
95% sample female  
53% White, 35% Asian/Pacific  
68% highest degree was Bachelor’s, 20% had a diploma  
28% had less than 6 years’ experience and 55% had greater than 10 years’ experience  
75% preferred a lecture learning environment  
52% reported being visual learners  
82% reported being unaware of PU clinical guidelines  
37% had most recent PU knowledge > 4 years ago | Participants were randomly assigned to:  
- traditional class teaching: 1 hour long sessions presented by a wound ostomy nurse using oral presentation and slides. Sessions had defined learning objectives. Sessions were run over a two week period to allow all staff to attend. (n=20)  
- computer based learning: self-learning module developed by the wound ostomy nurse based on the same learning objectives as the class room teaching and containing the same slides. Nurses had two weeks to do the module. (n=20)  
- control: no education (n=20) | Pre-test knowledge  
- No significant difference in three groups at pre-test knowledge measure (p=0.537)  
Post-test knowledge  
- Significant differences between three groups from pretest to posttest (p<0.001)  
- Lecture group had significantly greater increase in scores than the computer group (p=0.043)  
3 month knowledge  
- Significant differences between three groups from posttest to 3-month test (p=0.00)  
- No significant difference between mean improvements for lecture versus computer groups (p=0.717)  
6 month knowledge  
- No significant differences for any group between 3-month and 6-month scores (p=0.405)  
- Study conclusions: computer-based learning is a viable learning option and has greater flexibility. Increased knowledge of PU management was sustained over 6 months, with greatest knowledge loss in the first 3 months following education. |  |
|  | Limitations and comments |  |  |  |  |  |
|  | Hawthorne effect is a potential limitation  
Self-selection may limit findings as may be a highly motivated group  
Independent learning may influence findings | Indirect evidence: no association made between knowledge and attitudes and PU outcomes |  |  |  |  |

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## Clinical question one: What valid and reliable assessment methods are available to evaluate health professional knowledge of pressure injury prevention and treatment?

### Methods of Assessing Knowledge

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<td>Manderlier et al., 2017</td>
<td>To develop a tool to measure the knowledge of nurses on PU prevention</td>
<td>Study conducted in Belgium</td>
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<td></td>
<td>Number of participants:</td>
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<td></td>
<td>Phase 1 Pilot study: Setting: 1 general hospital, 2 university hospitals and 2 nursing homes - two groups of experts: 1 nursing student and 4 nurses (one specialized in wound care)</td>
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<td>- Phase 2 – convenience sample of 342 participants (228 nurses and 114 nursing students)</td>
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<td></td>
<td>Characteristics of participants:</td>
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<td></td>
<td>Nurses: 86% hospital; 14% nursing home; 57.9% &gt; 35 y; 55.7% &gt; 10 y professional experience;</td>
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<td></td>
<td>Students: bachelor program – 62.3%; diploma program - 37.7%;</td>
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<td>Three phase study: Phase 1 - instrument development and validation with experts on wounds; Phase 2 – psychometric evaluation of the tool; Phase 3 – revision based on the psychometric evaluation)</td>
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<td></td>
<td>• PU knowledge assessment tool</td>
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<td></td>
<td>• Validity of the multiple-choice test items</td>
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<tr>
<td></td>
<td>• Construct validity</td>
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<td></td>
<td>Outcome</td>
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<td>Nurses: Total score on tool varied from 5 to 22, of a maximum of 25 (average score – 13)</td>
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<td>Students: Total score on tool varied from 1 to 17, of a maximum of 25 (average score – 9.63)</td>
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<td></td>
<td>Conclusion: The PUKAT 2.0 demonstrated good psychometric properties and can be used and disseminated internationally to assess knowledge about PU prevention in nursing education, research and practice.</td>
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<td>• It has to be taken in account that the assessment of participants’ knowledge is a snapshot although knowledge is continuously affected by daily experiences and learning opportunities.</td>
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<td></td>
<td>Indirect evidence (PU not an outcome, psychometric study)</td>
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<tr>
<td>Pieper &amp; Zulkowski, 2014</td>
<td>Cross-sectional study exploring development and testing of a pressure injury knowledge test</td>
<td>• Participants were recruited from pressure injury conference attendees (n=108)</td>
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<td>Participant characteristics:</td>
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<td></td>
<td>• Mean age 46-48 years</td>
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<td></td>
<td>• Between 50% and 56% of participants had read EPAUP/NPUAP guidelines</td>
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<td></td>
<td>• Phase 1 nurses had significantly more</td>
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<td>Development of the knowledge test (PZ-PUKT) was based on content from research and guidelines Change were made to existing PUKT Phase 1 test: One cohort (n=54) completed the prevention/risk and staging questions (total 60 items)</td>
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<td></td>
<td>• Internal consistency (Cronbach’s α)</td>
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<td></td>
<td>• PZ-PUKT took 20-30 minutes to complete</td>
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<tr>
<td></td>
<td>• Cronbach’s α = 0.80 for overall test</td>
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<td>• Staging questions: α = 0.67</td>
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<td>• Prevention/risk: α = 0.56</td>
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<td>• Wound description: α = 0.64</td>
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<td>Scores based on experience</td>
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<td></td>
<td>• Nurses certified in wound care scored significantly better than non-certified</td>
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<tr>
<td></td>
<td>• Small sample size</td>
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<td></td>
<td>• No test-retest reliability performed</td>
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<td></td>
<td>• Participants came from a range of backgrounds</td>
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<td></td>
<td>Indirect evidence (PU not an outcome, psychometric study)</td>
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### Health Professional Education: Data Extraction and Appraisals

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</table>
| Moya-Suarez, Morales-Asencio, Aranda-Gallardo, Enriquez de Luna-Rodriguez, & Canca-Sanchez, 2017 | Development and psychometric validation of instrument for the evaluation of adherence to pressure injury prevention recommendations, the Questionnaire Adherence to Recommendations for Preventing Pressure Ulcers (QARPPU), | On-line survey to nurses in multicenter study of 9 hospitals in several regions in Spain. | Phase one: instrument design and content validation five experts on PI who were members other PI committee with experience in care, education, and research; content validity was calculated followed by a pilot (20 hospital nurses). Phase 2: Psychometric validation-instrument sent online to nurses in nine hospitals in Spain | - Questionnaire development  
- Content validity  
- Construct validity  
- Reliability  
- Discriminant power | Outcome:  
A valid and reliable instrument to evaluate nurse adherence to EBP recommendations to prevent PI  
Conclusion: The instrument is suitable for measuring or evaluating nursing adhering to PI prevention recommendations. Performing an evaluation of current practice and how decisions are made allows for identifying gaps of implementing EBP. | - Since the instrument was administered online the respondent’s answers may be biased (desired rather than usual practice)  
- Only evaluated for prevention in hospital setting  
- This was designed to measure adherence to PI prevention,  
Indirect evidence (PU not an outcome)  
Quality: Moderate |
| Tulek, Polat, Ozkan, Theofanidis, & Togrol, 2016 | Evaluate the validity and reliability of the PUPKAI-T (Turkish version of PUPKAI) | Conducted in one hospital in Turkey (n=150 participants with Re-testing: 46 nurses) | N/A | - Validity and reliability  
- Knowledge assessment of correct answers in PUPKAI-T test and re-test two weeks after the first one  
Psychometric qualities  
- Internal consistency reliability: KR-20 was 0.803.  
- Item difficulty indices between p>0.21 and p<0.88.  
Results  
- Nurses working in medical wards scored higher in Theme 2 | - Sample characteristics’ differences  
- Further research needs to be conducted on larger scale  
Indirect evidence (PU not and outcome)  
Quality: Moderate |
### Health Professional Education: data extraction and appraisals

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<tr>
<td>D. Beeckman, Defloor, Demarre, Van Hecke, &amp; Vanderwee, 2010</td>
<td>Psychometric study on validation of a tool for measuring attitudes to PU</td>
<td>Convenience sample of nurses (n=258) and nursing students (n=291) in Belgium</td>
<td>Validation of a survey tool measuring attitudes of nurses toward PUs</td>
<td>APuP measures:  • Personal competency  • Priority of PU care  • Impact of PU  • Responsibility in PU care  • Confidence</td>
<td>(classification and observation) (z = -2.424, p =0.015),  • surgical nurses had higher scores in Theme 4 (nutrition) (z = -3.447, p = 0.001), and Theme 6 (preventive measures to reduce the duration of pressure/shear) (z = -1.867, p = 0.062).  • No statistically significant difference between the scores based on education level  • Moderately significant relationship between knowledge scores and years of clinical experience (r = 0.179, p = 0.029, for theme 1; r = 0.145, p = 0.077 for theme 2; r = 0.254, p = 0.002 for theme 2, and r = 0.259, p = 0.001 for overall instrument).  • No significant difference was found between the knowledge scores of those who use a pressure ulcer risk assessment instrument and those who do not.</td>
<td>Author conclusions: PUPKAI-T is a suitable instrument for measuring nurses’ knowledge on PU prevention.</td>
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</table>

D. Beeckman, Psychometric study on development and validation of a survey tool measuring APuP measures:  • Personal competency  • Construct validity Known groups technique – groups with high level of expertise had a statistically significant difference in scores.  • Used known groups to test and support validation  • Convenience sample that may not be representative of nurses as a group  |  |  |  |  |  |  |

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| Vanderwee, et al., 2010 | development and validation of a tool for measuring attitudes to PU | (n=296) in Belgium and Netherlands | attitudes of nurses toward PUs Tool was developed based on literature review and face and content validity by 9 PU experts | • Priority of PU care  
• Impact of PU  
• Responsibility in PU care Confidence | significantly higher score on APuP, as expected.  
Internal consistency  
Cronbach’s alpha = 0.77 for overall  
Lowest internal consistency in ‘risk assessment’ (Cronbach’s alpha = 0.40)  
Highest consistency in ‘reduction of magnitude of pressure and shear’ (Cronbach’s alpha = 0.87)  
Test-retest reliability  
intraclass coefficient (ICC) = 0.88 (95% CI 0.79 to 0.93, p<0.001) | no association made between knowledge and PU outcomes |

| Dimitri Beeckman, Schoonhoven, Boucque, Van Maele, & Defloor, 2008 | RCT investigating the effect of a PUCLAS2 e-learning package | Convenience sample of nursing students (n=214) and qualified nurses (n=212) from hospitals, aged care, community care and a nursing school in Belgium | • Nurses and students randomly assigned to receive either the PUCLAS2 or standard education  
• Experimental group received e-learning in a private computer class using PUCLAS2  
• Control group received a standardized lecture using a PowerPoint that included the same content  
• Web education for both groups, 1 hour Pressure Ulcer Classification (PUCLAS2) includes:  
• classification of PUs  
• differentiation between PU and moisture lesions variations of task difficulty | • Participants classified PUs presented in digital photos  
• Photos had been previously validated by an expert group and had 100% agreement on PU classification  
• Two sets of 20 photos were alternated in the post test | Pre-test (100% completed)  
• No statistically significant difference in Interobserver reliability between experimental group and control group (35% agreement (fair) in both groups, p=0.93)  
Post test one (1 month, 100% completed)  
• Interobserver reliability increased compared to pretest in both groups (p=0.003)  
Post test 2 (2 months, 60 to 64% completed)  
• Significantly worse interobserver reliability for both groups vs first posttest (p<0.001 both groups)  
Significantly better interobserver reliability vs pretest for (both groups p<0.001)  
Post test 3 (3months, 57% completed)  
• Significantly worse interobserver reliability for both groups vs first posttest (p<0.001 both groups)  
Significantly better interobserver reliability vs pretest for (both groups p<0.001) | Comparison between control and experimental groups is not made  
Impact of self-education and work experience throughout timeframe of study is not discussed  
No relationship between education and practice is expired |

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<tr>
<td></td>
<td>Knowledge Levels (Background information)</td>
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<td>Meesterberends, Wilborn, Lohrmann, Schols, &amp; Halfens, 2014</td>
<td>Cross sectional study to determine nurses knowledge and use of prevention of pressure injuries in perioperative patients.</td>
<td>• Participants were recruited in nursing home in Netherlands (n=10, n=600 staff) and 11 homes in Germany (n=578 staff)</td>
<td>N/A</td>
<td>PUQ-2003 includes two parts. The first part requires the respondents to evaluate the usefulness of the preventive measures; second part asks the respondents to judge their practice in terms of preventive measure</td>
<td>only 19.2% (the Netherlands) and 24.6% (Germany) of preventive measures were judged correctly as non-useful.</td>
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<td>J. Cox, Roche, &amp; Gandhi, 2013</td>
<td>Cross sectional study to determine physicians knowledge and use of prevention of pressure injuries in perioperative patients.</td>
<td>• Participants were physicians recruited in critical care (n=65) Characteristics: • 75% male • 69.6% between 30 and 50 years of age</td>
<td>N/A</td>
<td>Pieper Pressure Ulcer Knowledge Tool • New survey tool to collect information on attitudes/beliefs section of (14 questions with responses ranked using an ordinal, 5-point Likert-type scale.)</td>
<td>69% of physicians had experienced poor to adequate basic medical education training on pressure injury prevention and treatment. • 60% had never received a pressure injury lecture. • 71.4% physicians reported their role to be important to very important in the areas of PrU prevention • 67.9% physicians reported their role to be important to very important in the areas of treatment</td>
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<td>Trinkoff et al., 2015</td>
<td>Cross sectional study (secondary)</td>
<td>• 2004 national Nursing Home Survey (NNHS) was used for data on leadership and facility</td>
<td>N/A</td>
<td>Leadership variables Education and certification of DONs and administrators</td>
<td>Education and certification of nursing home administrators was</td>
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<td>analysis) investigating relationship between administrator/director of nursing (DON) education and PU</td>
<td>characteristics. Data was collected from a representative sample (n=1500) nursing homes in the US. • Administrators at 1174 nursing homes completed computer assisted data collection (response rate 81%) • Of these 1142 had usable data on the facility (MDS 2.0) that could be linked to administrator responses. Characteristics: Certification • 72.2% of administrators and 57.5% of DONs had no formal certification Education • 32.2% of administrators and 7.4% of DONs had Master’s or higher • 50.4% of administrators and 35.6% of DONs had bachelor’s or higher</td>
<td>Nursing home resident outcomes • High risk pressure ulcers: proportion of residents with stage I to IV Pus who have impaired bed mobility or transfer or comatose of malnutrition • Low risk pressure ulcers Any resident not at high risk The analysis controlled for facility size, and profit vs non-profit</td>
<td>not significantly associated with high or low risk pressure ulcers. • Nursing homes led by DONs with any certification had significantly less in high-risk pressure ulcers (7.4% decrease, p = 0.001) • Nursing homes led by DONs certified by ANCC-gerontological nursing had 13.4% lower rate of high-risk pressure ulcers (p&lt;0.001) but were significantly more likely to have higher rates of low risk PUs (p=0.010) • Study conclusions: Specialty certification of DONs is linked to reduction in adverse resident events.</td>
<td>Analysis did not adjust for case-mix as confounding variable</td>
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<td>Simonetti, Comparcini, Flacco, Di Giovanni, &amp; Cicolini, 2015</td>
<td>To determine nurse students knowledge and attitude regarding the prevention of pressure injuries</td>
<td>Cross sectional study in seven Italian nursing schools (n=742) Inclusion: Bachelor of Science in Nursing students Characteristics: • Mean age 22.1 years • Primarily female (74.3%) • Primarily first year of course (40.6%)</td>
<td>Knowledge Assessment Instrument APuP</td>
<td>overall Knowledge 51.1% (13.3/26) overall Attitude score 76.7% (39.9/52) • Significant correlation between attitudes and knowledge (p&lt;0.001) • Years of education, training experience were significantly related to both knowledge and attitudes</td>
<td>• Small convenience sample • Use of self reported data • Inability to generalize data</td>
<td>Indirect (PU not an outcome)</td>
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<th>Quality</th>
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</table>
| Tallier et al., 2017 | To determine nurses knowledge attitude, behaviors and barriers regarding the prevention of pressure injuries in perioperative patients. | Participants recruited in perioperative setting across 10 acute care hospitals in the US (n=62) | N/A             | 3 self reported questionnaires          | Nurse’s knowledge Knowledge deficit as performance of PUKT was below recommended 90% on all aspects including prevention/risk subscale, wound description subscale and ulcer staging subscale Knowledge as measured by the PUKT and availability of pressure injury staging tool were statistically significant predictors of pressure ulcer prevention behavior (p<0.05) The study findings indicate perioperative nurses have a knowledge deficit about pressure ulcer prevention that may have predicted behavior requiring education intervention aimed at lowering pressure ulcer incidence and improving patient outcomes in the perioperative area. | • Small convenience sample   
• Lack of external and internal validity  
• Use of self reported data  
• Inability to generalize data | Indirect (PU not an outcome) |
| Lee & Yeun, 2016 | To assess the relationship between home care workers knowledge of pressure ulcers | Participants were nurses recruited in home care settings in Korea (n=129) | N/A             | Knowledge Concerning Pressure Ulcer tool to measure knowledge | Knowledge  
• Statistically significant difference based on education levels (p<0.001) and attendance at pressure injury event in preceding 12 months (p=0.044)  
• No differences in knowledge based on age of nurses, working experience, hours worked/week.  
Pressure Injury Care Performance  
• Performance of pressure injury care was statistically related to:  
  o age (p<0.001),  
  o education level (p=0.005)  
  o number hours worked/week (p=0.033) | • Used pressure ulcer knowledge measurement instrument (reliability and validity not reported though cited) | Indirect: PU not an outcome | High |
## Health Professional Education: data extraction and appraisals

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| Kaddourah, Abu-Shaheen, & Al-Tannir, 2016 | Cross sectional study reporting current knowledge and attitudes about pressure ulcer prevention in acute rehabilitation seeing among a group of interprofessional colleagues | Participants were recruited in an acute rehabilitation in Saudi Arabia (n=120 invited, n=105 participated)  
Inclusion criteria:  
• Direct care providers (nurses, physical and occupational therapists, and physical medicine in rehabilitation) working directly with patients in the rehabilitation hospital  
• At least one year of clinical experience | Invitation letter to all eligible staff, a copy of questionnaire, cover page describing the nature and voluntary study. Research coordinator immediately collected the survey. | Pressure injury was not a direct outcome measure  
Attitudes  
• Majority of participants possessed over all knowledge but unsatisfactory attitudes for prevention of pressure ulcers. (mean score 71.5%)  
• Physiotherapists were the least interested in preventing pressure injuries  
• All believed risk assessment to be an important component of plan, | no differences in performance based on working experience.  
There was a significant correlation between:  
• performance and knowledge (r=0.256,p=0.003)  
• performance and knowledge of risk factors (r=0.193,p=0.0028)  
• performance and knowledge of pressure injury healing and prevention (r=0.207,p=0.019) | Author conclusions: Education for staff on PU is important |
| Douglas et al., 2016 | A consensus Delphi survey to determine nurse opinion | Participants were senior acute care registered nurses in one tertiary hospital in Australia who were purposively selected (n=35) | An initial panel of 150 nurses developed a list of core skills | Core skills accepted by the group  
• Inspect skin integrity 97.1% agreement that this is a core skill | Assessed mean knowledge score according to general characteristic using the personal profile.  
• Used a cut off ≥70 point for the knowledge concerning PU prevention | Indirect evidence: PU not an outcome measure  
Quality: moderate |

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### Ref

#### on core skills for nurses in acute care

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| Romero-Collado, Homs-Romero, & Zabaleta-del-Olmo, 2013 | Cross sectional survey to determine what primary care nurses and physicians know about items related to prevention and treatment of pressure injuries | Participants recruited in 10 primary care services in Spain through written invitation (n=127) Inclusion criteria:  
- Nurse or physician working in study area  
Participant characteristics: 64.8% nurse participants and 46% physicians | Both groups completed a self-administered questionnaire in the presence of researcher | Univariate descriptive analysis for qualitative and quantitative variables.  
- Statistical significance established as P<0.05  
- Single questionnaire – 2 parts completed concurrently | Outcome 1  
Both nurses and physicians agreed that professional responsibility for pressure injuries and wound care was the nurses’ (p= 0.015)  
Both groups indicated that patients would benefit if nurses prescribed pressure injury and wound care products (p=0.113)  
**Author conclusions:** Nurses have experience to prescribe appropriate medications and healthcare products for the prevention and treatment of pressure injuries and should take that responsibility | No evidence that performing these core skills decreases PU |

#### Cross sectional survey to determine what primary care nurses and physicians know about items related to prevention and treatment of pressure injuries

- Participant characteristics: Grade 5 (60.7%) and Grade 6 (30.7%) nurses  
- Mean experience level 11±9.4 years  
- 86% female  
- Mean age 37 years (range 21 to 65)  
- 24% internal medicine, 36% surgical/preop, 11.3% critical care, 16% cancer care

- 40 skills that could be considered core skills for acute care nurses  
- The expert panel of 35 nurses engaged in focus groups to discuss the core skills  
- Three Delphi rounds were conducted with participants voting using a 5-point Likert scale regarding whether they considered each skill a core skill  
- Skills were eliminated when <80% of participants agreed

- Inspect and palpate skin for signs of pressure injury 91.4% agreement that this is a core skill

- No evidence that performing these core skills decreases PU

**Limitations and comments:**

- No evidence that performing these core skills decreases PU

**Indirect (PU not an outcome measure)**
<table>
<thead>
<tr>
<th>Ref</th>
<th>Type of Study</th>
<th>Sample</th>
<th>Intervention(s)</th>
<th>Outcome Measures &amp; Length of Follow-up</th>
<th>Results</th>
<th>Limitations and comments</th>
</tr>
</thead>
</table>
| Saleh, Al-Hussami, & Anthony, 2013       | To ascertain nurse knowledge, implementation, and utilization of PU prevention/treatment based upon PU guidelines | Nurses recruited in acute care setting in Jordan (n=460)                | Three part questionnaire to assess nurse’s knowledge and practice of PU prevention and treatment.  | • Level of PU knowledge and treatment in relationship to established PU guidelines.  
• Frequency of PU prevention and treatment interventions  
• Variation in nursing practice. | Pressure injury interventions  
• Teaching and private hospitals had higher level of implementation than government or military hospitals.  
• Implementing pressure injury treatment was significantly higher for nurses with more years of experience (p = 0.03).  
• Higher level of education significantly positively affected implementation of prevention (p = 0.01).  
• Nurses with associated degree had higher scores than those with BSc, MSc and PhD. | • Possible response bias due to imbalance in positive/negative responses in survey.  
• Questionnaire developed by authors was not tested.  
• Large sample size  
• First study of knowledge of pressure injury prevention and treatment in Arab countries. |
| Smith & Waugh, 2009                      | Descriptive study investigating professional knowledge of PU         | Convenience sample of nurses in a range of US health facilities (n=96) | No intervention – knowledge survey.  | Pieper Pressure Ulcer Knowledge Test (PPUKT)  | Nurses who had self-reported exposure to pressure ulcer education scored significantly better | Self-selecting sample group may favor those with more knowledge and/or confidence |
| Chianca, Rezende, Borges, Nogueira, & Caliri, 2010 | Descriptive study investigating professional knowledge of PU        | Convenience sample of nurses in one hospital in Brazil (n=106)          | No intervention – knowledge survey.  | Pieper Pressure Ulcer Knowledge Test (PPUKT)  | Participants had greater knowledge of prevention versus assessment (mean score 79% versus 57.4%)  
Recent graduates scored significantly better than nurses with longer experience (p = 0.033) | Self-selecting sample group may favor those with more knowledge and/or confidence  
• Limited to one facility |
<table>
<thead>
<tr>
<th>Ref</th>
<th>Type of Study</th>
<th>Sample</th>
<th>Intervention(s)</th>
<th>Outcome Measures &amp; Length of Follow-up</th>
<th>Results</th>
<th>Limitations and comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iranmanesh, Rafiei, &amp; Foroogh Ameri, 2011</td>
<td>Descriptive study investigating professional knowledge of PU</td>
<td>Convenience sample of critical care nurses in 5 hospitals in Iran (n=126)</td>
<td>No intervention – knowledge survey</td>
<td>Translated version of Pieper Pressure Ulcer Knowledge Test (PPUKT)</td>
<td>Approximately 54.36% of questions answered correctly</td>
<td>Self-selecting sample group may favor those with more knowledge and/or confidence</td>
</tr>
<tr>
<td>El Enein &amp; Zaghoul, 2011</td>
<td>Descriptive study investigating professional knowledge of PU</td>
<td>Convenience sample of nurses in one hospital in Egypt (n=122)</td>
<td>No intervention – knowledge survey</td>
<td>Questionnaire developed using Delphi technique</td>
<td>Mean score (63% ± 8.6%) considered to be poor result</td>
<td>Self-selecting sample group may favor those with more knowledge and/or confidence</td>
</tr>
<tr>
<td>Aydin &amp; Karadağ, 2010</td>
<td>Descriptive study investigating professional knowledge of PU</td>
<td>Convenience sample of nurses in 3 health facilities in Turkey (n=237)</td>
<td>No intervention – knowledge survey</td>
<td>Questionnaire developed by the researchers</td>
<td>Nurses who had a Bachelor’s or Masters degree scored significantly better (p=0.004) Nurses who attended post-graduation PU prevention and management training scored significantly better (p=0.012). No association between years’ experience and knowledge levels</td>
<td>Self-selecting sample group may favor those with more knowledge and/or confidence</td>
</tr>
<tr>
<td>Zulkowski, Ayello, &amp; Wexler, 2010</td>
<td>Descriptive study investigating professional knowledge of PU</td>
<td>Convenience sample of nurses in health facilities in US (n=460)</td>
<td>No intervention – knowledge survey</td>
<td>Pieper Pressure Ulcer Knowledge Test (PPUKT)</td>
<td>Nurses with wound certification scored significantly better on the test than those who did not (89% versus 76.5%, p&lt; 0.0) Nurses with wound certification were more likely to report attended lectures, read journal articles, sought internet information and read recent PU clinical practice guidelines</td>
<td>Self-selecting sample group may favor those with more knowledge and/or confidence</td>
</tr>
</tbody>
</table>
### Ref

**Gupta, Loong, & Leong, 2012**  
Descriptive study investigating professional knowledge of PU  
Convenience sample of nurses (n=39) and registrars (n=13) working in two SCI units in Australia

**Miyazaki, Caliri, & Santos, 2010**  
Descriptive study investigating professional knowledge of PU  
Convenience sample of nurses (n=136) and auxiliaries (n=250) recruited in an aged care hospital in Brazil.

**Gallant, Morin, St-Germain, & Dallaire, 2010**  
Descriptive correlational study describing nurse knowledge and its relationship to practice  
A convenience sample of nurses was recruited in one university hospital in Canada (n=256)

### Type of Study

- Descriptive study
- Descriptive correlational study

### Sample

- Convenience sample of nurses and registrars working in two SCI units in Australia
- Convenience sample of nurses and auxiliaries recruited in an aged care hospital in Brazil
- A convenience sample of nurses was recruited in one university hospital in Canada

### Intervention(s)

- No intervention – knowledge survey
- No intervention
- No ‘intervention’; this was an observational study consisting of survey of nurse demographics and PU knowledge correlated with observed behavior gathered from nurse charting.

### Outcome Measures & Length of Follow-up

- 24-item questionnaire developed by the researchers
- Pieper Pressure Ulcer Knowledge Test (PPUKT)
- Nurse knowledge: Adapted questionnaire based on the Pieper and Mott Pressure Ulcer Knowledge Test

### Results

- No significant difference in overall scores between doctors and nurses (mean 12.54 vs 12.33, p>0.05)
- Nurses with > 10 years’ experience had highest scores (mean 12.15) but there was no significant difference (p>0.05)
- No significant difference between areas of work (both had SCI patients) for prevention knowledge but one unit had better results on management knowledge (p<0.001)
- Registrars scored better in prevention questions than in management questions
- Mean scores for nurses was 79.4% (SD 8.3%)
- Mean score for auxiliaries was 73.6% (SD 9.8%)
- Scores for auxiliaries decreased with time since previous education (p = 0.009) and with time working in the hospital (p=0.049)
- No significant difference for nurses based on time since education or time in the hospital
- Nurses who reported attending a 7 hour and 25 minutes continuing education session had significantly greater knowledge scores than those who had attended either a one hour training session or no additional training (p<0.0037)

### Limitations and comments

- Self-selecting sample group may favor those with more knowledge and/or confidence
- Non-validated measurement tool
- Self-selecting sample group may favor those with more knowledge and/or confidence
- Indirect evidence: no association made between knowledge and PU outcomes

---

*Data Tables: 2019 Guideline Update: Health Professional Education*

© EPUAP/NPIAP/PPPIA
### Health Professional Education: data extraction and appraisals

<table>
<thead>
<tr>
<th>Ref</th>
<th>Type of Study</th>
<th>Sample</th>
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</table>
| Demarré et al., 2012 | Observational study exploring the relationship between knowledge, attitudes and practice | A convenience sample of nurses (n=54) and nursing assistants (n=91) from 18 nursing homes in Belgium | No ‘intervention’; this was an observational study consisting of survey of nurse demographics and PU knowledge correlated with observed behavior gathered from nurse charting. | Nurse knowledge measured using the Pieper Pressure Ulcer Knowledge Test (PPUKT) | • Follow up of Braden Scale assessments  
• Application of preventative care as related to Braden score  
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• Despite high knowledge on prevention measures there was low performance of prevention activities  
• Knowledge of initial evaluation 97% but implementation was 24%  
• Knowledge of Braden scale score was 86% but implementation was 3%  
• Knowledge of support surfaces was 84% but implementation was 57% | Performance. This lack of analysis also prevented control for other demographic characteristics.  
• Relied on documentation  
• Self-reported training |

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## Nurse experience of the PU carer role

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</tr>
</thead>
</table>
| Varga & Holloway, 2016 | Qualitative research study exploring the lived experience of being a PU nurse in order suggest practical solutions to practice | Purposive sample of wound care nurses in the UK (n=5) | N/A | Semi structured interviews with thematic analysis guided by interpretative phenomenological analysis | Eight themes with 25 sub themes established that broadly focused on:  
• Challenge involved in wound care and health care environment  
• Senseless wounds  
• Coping and self-care including concerns and coping defenses  
• Using knowledge and technology to answer questions, make a difference and guiding others  
• Knowing what the outcome will be  
• Holistic caring  
• Frustrations |  
• Rigor was promoted through researcher diary, reflexivity and informant validation of transcriptions  
• Potential influence of research bias  
• Possible that informants responded in ways they believed were expected  
Indirect (PU not an outcome measure) |

Inclusion criteria:  
• Wound care nurse in any care setting  
• Worked with individuals with PU for ≥ 3 years  
• Communicate in English  

Participant characteristics:  
• 4 participants had undergraduate degrees and one had a Master’s degree in wound healing  
• Aged > 50 years  
• Experience in wound care ranged from 3 to 20 years
### Attitudes of Health Professionals

<table>
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</tr>
</thead>
</table>
| Attitudes of Health Professionals | Cross sectional study exploring nurses attitudes to pressure injuries | Self-selecting sample of nurses from a university hospital in Turkey (n=660 eligible, n=426 responded) | n/A | Attitudes to Pressure Ulcer Prevention (APuP) tool Cronbach alpha value for internal consistency 0.79, Cronbach alpha values for factors 0.70 to 0.90 | Sources of knowledge  
- 85% of the nurses (n = 362) acquired information during nursing education  
- 8.5% (n = 79) followed journals and books  
- 19.7% (n = 84) gained information from conferences and congresses  
- 16.3% (n = 69) benefited from the internet  
Attitudes  
- Attitude scores of the nurses who had read the 2009 EPUAP/NPUAP guideline were higher than those who had not (p<0.05)  
- Nurses “strongly agreed” with the priority of pressure ulcer prevention at the highest rate (43.9%)  
- Total attitude scores of nurses who had last received training 0-6 months previously were significantly higher than those who had last received training > 2 years previously (p < 0.01) | Indirect (Pressure injury not an outcome measure) quality: High |
Table 1: Level of Evidence for Intervention Studies

<table>
<thead>
<tr>
<th>Level</th>
<th>Experimental Designs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>Randomized trial</td>
</tr>
<tr>
<td>Level 2</td>
<td>Quasi-experimental design</td>
</tr>
<tr>
<td></td>
<td>Prospectively controlled study design</td>
</tr>
<tr>
<td></td>
<td>Pre-test post-test or historic/retrospective control group study</td>
</tr>
<tr>
<td>Level 3</td>
<td>Observational-analytical designs</td>
</tr>
<tr>
<td></td>
<td>Cohort study with or without control group</td>
</tr>
<tr>
<td></td>
<td>Case-controlled study</td>
</tr>
<tr>
<td>Level 4</td>
<td>Observational-descriptive studies (no control)</td>
</tr>
<tr>
<td></td>
<td>Observational study with no control group</td>
</tr>
<tr>
<td></td>
<td>Cross-sectional study</td>
</tr>
<tr>
<td></td>
<td>Case series (n=10+)</td>
</tr>
<tr>
<td>Level 5</td>
<td>Indirect evidence: studies in normal human subjects, human subjects with other types of chronic wounds, laboratory studies using animals, or computational models</td>
</tr>
</tbody>
</table>

Table 2: Levels of evidence for diagnostic studies in the EPUAP-NPUAP-PPPIA guideline update

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>Individual high quality (cross sectional) studies according to the quality assessment tools with consistently applied reference standard and blinding among consecutive persons.</td>
</tr>
<tr>
<td>Level 2</td>
<td>Non-consecutive studies or studies without consistently applied reference standards.</td>
</tr>
<tr>
<td>Level 3</td>
<td>Case-control studies or poor or non-independent reference standard.</td>
</tr>
<tr>
<td>Level 4</td>
<td>Mechanism-based reasoning, study of diagnostic yield (no reference standard).</td>
</tr>
</tbody>
</table>

Table 3: Levels of evidence for prognostic studies in the EPUAP-NPUAP-PPPIA guideline update

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>A prospective cohort study.</td>
</tr>
<tr>
<td>Level 2</td>
<td>Analysis of prognostic factors amongst persons in a single arm of a randomized controlled trial.</td>
</tr>
<tr>
<td>Level 3</td>
<td>Case-series or case-control studies, or low quality prognostic cohort study, or retrospective cohort study.</td>
</tr>
</tbody>
</table>

APPRAISAL FOR STUDIES PROVIDING DIRECT EVIDENCE (i.e. ELIGIBLE FOR SUPPORTING AN EVIDENCE-BASED RECOMMENDATIONS)

Each criteria on the critical appraisal forms was assessed as being fully met (Y), partially met or uncertain (U), not met/not reported/unclear (N), or not applicable (NA). Studies were generally described as high, moderate, or low quality using the following criteria:

- High quality studies: fully met at least 80% of applicable criteria
- Moderate quality studies: fully met at least 70% of applicable criteria
- Low quality studies: did not fully meet at least 70% of applicable criteria
# Health Professional Education: data extraction and appraisals

## CROSS SECTIONAL/SURVEY/PREVALENCE STUDIES/OBSERVATIONAL

<table>
<thead>
<tr>
<th>Endnote ID</th>
<th>Author/year</th>
<th>Focussed question</th>
<th>Sampling method</th>
<th>Representative sample</th>
<th>States/number invited</th>
<th>Participants</th>
<th>Clear outcome measures</th>
<th>Valid reliable outcome measurement</th>
<th>Comparable results for multiple sites</th>
<th>Confounders identified and accounted for</th>
<th>Minimal bias</th>
<th>Reliable conclusions</th>
<th>Level of evidence</th>
<th>Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>6700</td>
<td>Simonetti et al., 2015</td>
<td>Y</td>
<td>Y</td>
<td>U</td>
<td>Y</td>
<td>Y</td>
<td>U</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Indirect evidence</td>
<td>moderate</td>
</tr>
<tr>
<td>13730</td>
<td>Tayyib, Coyer, &amp; Lewis, 2016</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>NA</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Indirect evidence</td>
<td>High</td>
</tr>
<tr>
<td>10760</td>
<td>Avsar &amp; Karadag, 2016</td>
<td>N</td>
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<td>U</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Indirect evidence</td>
<td>low</td>
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<tr>
<td>10798</td>
<td>Aslan &amp; Yavuz van Giersbergen, 2016</td>
<td>Y</td>
<td>U</td>
<td>U</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Indirect evidence</td>
<td>moderate</td>
</tr>
<tr>
<td>10979</td>
<td>Kang, Kim, &amp; Lee, 2016</td>
<td>Y</td>
<td>U</td>
<td>U</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>NA</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>Low</td>
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<tr>
<td>11066</td>
<td>Hurtado, Berkman, Buxton, &amp; Okechukwu, 2016</td>
<td>Y</td>
<td>U</td>
<td>U</td>
<td>Y</td>
<td>N</td>
<td>U</td>
<td>N</td>
<td>N</td>
<td>U</td>
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<td>U</td>
<td>Low</td>
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<tr>
<td>15575</td>
<td>Ünver, Findik, Özkan, &amp; Sürücü, 2017</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
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<td>Moderate</td>
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<tr>
<td>16199</td>
<td>Tulek et al., 2016</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>NA</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
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## RCTS

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<th>Focussed question</th>
<th>Assignment randomised</th>
<th>Adequate concealment method</th>
<th>Subjects and investigators blinded</th>
<th>Groups comparable at commencement</th>
<th>Only difference was treatment</th>
<th>Valid reliable outcome measure</th>
<th>% drop out in study arms</th>
<th>reported and acceptable</th>
<th>Intention to treat analysis</th>
<th>Comparable results for multiple sites</th>
<th>Minimal bias</th>
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Data Tables: 2019 Guideline Update: Health Professional Education © EPUAP/NPIAP/PPPIA
### QUALITATIVE STUDIES

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<th>Comparable source populations</th>
<th>States number invited</th>
<th>Likelihood of outcome at enrolment</th>
<th>Per cent drop out in study arms</th>
<th>Outcome or measures</th>
<th>Assessment, blinded, or discussed potential bias</th>
<th>Valid, reliable assessment with supporting reference</th>
<th>More than one measure of exposure</th>
<th>Confounders identified and accounted for</th>
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Health Professional Education: data extraction and appraisals

SYSTEMATIC REVIEWS FOR DISCUSSION

RATING CRITERIA:
1 Partial yes: states review question, search strategy, in/exclusion criteria and risk of bias were a-priori; full yes: meta-analysis/synthesis plan, investigation of heterogeneity and justification for protocol deviation
2 Partial yes: At least 2 databases, provides keywords and search, justifies publication restrictions; full yes: searched reference lists of included studies, searched trial registries, consulted experts in field, searched grey literature, search within 24 months of review completion
3 At least two reviewers independently agreed on selection of studies to include or reviewers achieved 80% agreement on a sample of studies
4 Either two reviewers did data extraction and had >80% agreement, or two reviewers reached consensus on data to extract
5 Partial yes: list of all relevant studies that were read and excluded; full yes: every study that was excluded is independently justified
6 Partial yes: described populations, interventions, comparators, outcomes and research design; full yes: detailed descriptions of same plus study setting and timeframe for follow-up
7 FOR RCTS Partial yes: appraised risk of bias from unconcealed allocation and lack of blinding; full yes: appraised risk of bias on true randomisation, selection of reported result from multiple measurements/analyses
FOR non randomised studies: Partial yes: appraised confounding and selection bias; full yes: appraised methods to ascertain exposures and outcomes, selection of reported result from multiple measurements/analyses
8 Must include reporting of the source of funding of individual studies, or reports that the reviewers considered this even if individual funding sources aren’t listed in review

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<th>Endnote ID</th>
<th>Author/year</th>
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<th>Explicitly states a-priori protocol</th>
<th>Rationale for selection of study designs</th>
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<th>Duplicate study selection</th>
<th>Duplicate data extraction</th>
<th>Excluded studies listed</th>
<th>Adequate description of included studies</th>
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<th>Source of funding reported</th>
<th>Appropriate meta-analysis including weighting and adjustment for heterogeneity</th>
<th>Meta-analysis considers risk of bias of studies</th>
<th>Discussion consider risk of bias of studies</th>
<th>Assessment of publication bias if quantitative analysis is done</th>
<th>Potential conflicts of interest of authors reported and managed</th>
<th>Review Quality</th>
<th>Type of evidence included in review</th>
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Full reference list


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J Wound Ostomy Continence Nurs, 44(2), 123-128

Spinal Cord, 50(2), 159-164

Journal of Applied Gerontology, 35(2), 244-253

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International Wound Journal

Journal of Clinical Nursing, 23(13-14), 1948-1958

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Adv Skin Wound Care, 27(9), 413-419

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International Journal of Nursing Studies


