

Title: Understanding contextual barriers and enablers to pressure injury prevention practice in an Australian intensive care unit: an exploratory study.

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Abstract

Background

Skin integrity management is often a low clinical priority in the intensive care environment, possibly resulting in high pressure injury prevalence. This paper reports the results of the first phase of a multi-phased project, 'Translating evidence-based presSURE injury prevention STRategies to the INTensive care environment (SUSTAIN study)'. The SUSTAIN study used a research translation framework to guide the assessment of research uptake, development and monitoring of translational strategies to reduce pressure injuries.

Objective

The objective was to assess the enablers and barriers to research translation of evidence-based skin integrity management in one Australian tertiary referral intensive care unit.

Methods

This exploratory study was conducted in an Australian metropolitan tertiary intensive care unit on a sample of 204 registered nurses. Data was collected using 1) a descriptive cross-sectional cohort survey of barriers, enablers and attitudes to pressure injury prevention, 2) a cross sectional survey of pressure injury knowledge, and 3) focus groups to understand the local contextual factors impacting registered nurses' pressure injury prevention practice.

Results

Participants reported a moderate to high ability to rise above barriers in pressure injury prevention, a positive attitude towards pressure injury prevention and considered this a priority in their care of patients. High patient acuity emerged as a barrier to implementing timely pressure injury prevention strategies. In the knowledge test participants with postgraduate qualifications answered more statements correctly. Focus group data revealed four themes; Team ICU, Processes of care, Education for Consistency and The Patient.

Conclusions

It is essential that evidence-based pressure injury prevention strategies are provided in the intensive care environment. Our findings indicate that despite positive attitudes and sound knowledge levels high patient acuity is a significant barrier to evidence implementation.

ACKNOWLEDGEMENTS

We thank all RNs who participated in this phase of the study. This study was funded by a Research Implementation Fellowship for F Coyer from the Health Innovation, Investment and Research Office, Queensland Health.

INTRODUCTION

Loss of skin integrity during illness is a complex phenomenon entailing interactions between immobility, pressure, shear, friction, moisture and poor nutrition.¹ These variables are endemic in patients admitted to the intensive care unit (ICU). Critically ill patients are commonly immobile, unable to change their position and, importantly, often unable to sense pressure from prolonged periods in one position due to their underlying pathophysiology, continuous administration of intravenous sedation and pain relief.^{2,3} As such, critically ill ICU patients are a vulnerable population at high risk, or very high risk, of disruption to skin integrity, particularly the development of pressure injuries (PI).⁴

Most PI are avoidable yet rates of PIs reported in Australian ICUs are unacceptably high ranging from 18-50%.^{2,5} Pressure injuries have been shown to extend length of hospital stay by 4.31 days with costs of treating PIs estimated at AU\$983 million per annum.^{6,7} A growing body of clinical research examining the mechanics of PI prevention has translated into national and international evidence-based clinical guidelines which provide a framework for quality care.¹ Despite this, skin integrity management is in practice often a low clinical priority in the intensive care environment, resulting in high PI prevalence.⁸ Further, variation in clinical practice for example, variations in processes of care among clinicians, or different knowledge levels or commitment of staff, is a key variable mediating the delivery of PI prevention strategies.⁹ Clinical guidelines are not prescriptive and often lack strategies to achieve and maintain low PI rates.¹⁰ Thus, guidelines alone are not sufficient to reduce PI rates.

In response to unacceptably high PI prevalence, various strategies have been devised to reduce the prevalence and severity of pressure injuries in intensive care units.^{2,11} One such strategy was the development of the Interventional patient Skin integrity Protocol in a high Risk Environment (InSPiRE) program, a package of established evidence-based interventions to prevent PI.² This 'bundled' approach has demonstrated potential to reduce the rate of PIs in the ICU.¹¹ Coyer and colleagues completed a trial implementation of InSPiRE in a single centre tertiary referral ICU and showed that InSPiRE was effective in reducing PI cumulative incidence to 18% in the intervention group from 30.4% in the control group ($p=0.039$).² Despite achieving promising results during the study period, subsequent monthly incident reports from the same institution show large fluctuations in the number of new PIs

reported per month in the ICU.¹² This lack of sustained translation into practice indicated an imperative for change to skin management in this vulnerable patient population and unique clinical environment.

This study therefore used a research translation framework, the Ottawa Model for Research Use (OMRU),^{13,14} to guide sustained uptake of evidence based interventions into the clinical practice domain. The ORMU requires that input, process and output elements be systematically assessed, monitored and evaluated (AME) to facilitate effective research translation into practice. The AME structure identifies the nature of barriers, supports and possible enablers to research use associated with the practice environment (the ICU), adopter characteristics (specialist nurses), and the clinical innovation (the bundle of the best available evidence to improve skin integrity). Strategies to transfer the intervention are based on the situational assessment.

This paper reports on the results of the first phase of a comprehensive multi-phased project, Translating evidence-based presSURE injury prevention STRategies to the INTensive care environment (SUSTAIN study). The SUSTAIN study consisted of three phases (Figure 1). Phase 1 of the study identified the nature of existing barriers and supports, both tangible and intangible, to evidence-based PI prevention practices.

Research Objective and Aim

The objective of this study was to systematically assess the enablers and barriers to research translation of evidence-based skin integrity management and PI injury prevention in the intensive care environment. Hence, the aim of this study was to explore registered nurse (RN) attitudes towards, and knowledge of, PI prevention strategies in one Australian tertiary referral ICU.

MATERIALS AND METHODS

Design

Phase 1 entailed a multiple methods exploratory design comprising of 1) a descriptive cross-sectional cohort survey of attitudes, barriers and enablers to PI prevention 2) cross sectional survey of knowledge

of PI staging and prevention and 3) focus groups to understand local contextual factors impacting RNs' PI prevention practice.

The study received ethical approval from the respective hospital (HREC/15/QRBW/24) and university Human Research Ethics Committees (QUT1500000139).

Setting

The study was conducted in the ICU of a major metropolitan public hospital in Queensland, Australia which admits over 2400 patients per annum. Patients admitted to this ICU are high acuity and common medical diagnoses include; acute neurological disorders, respiratory diseases, renal dysfunction, burns, sepsis and multi-trauma injuries. The ICU is a 36 bed unit operationally and physically divided into 4 'pods', each of 9 beds. Each 9-bed pod is staffed independently. The ICU is currently funded for 22 high acuity beds. The unit is staffed with approximately 200 registered nurses (RNs) who deliver, and are responsible for, complete patient care in a ratio of one RN to one mechanically ventilated patient.

Population and study sample

At the time of the study 204 RNs were employed in the ICU study site comprising of seven senior RNs (three clinical nurse consultants, two nurse managers [one staffing and one equipment], two nurse educators) and 197 RNs responsible for delivery of clinical care. All 204 RNs were included in this study. A convenience sampling method was used for the focus groups where those RNs who were working at the time of the scheduled focus groups were invited to participate in the test.

Instruments

Survey

The survey comprised three sections; demographic information; RNs' attitudes to PI care and prevention in the ICU, and potential barriers and enablers to optimal PI prevention. Thirteen items were taken from the Attitudes towards Pressure Ulcer Prevention instrument (APuP)¹⁵ and 23 items were taken from the Barriers and Facilitators for Pressure Ulcer Prevention in the Paediatric Intensive Care Unit.¹⁶ Both instruments were used with permission from the respective authors.

The APuP instrument consists of 13 items and covers five dimensions of RNs' attitude towards: personal competency to prevent PIs; the priority of PI prevention; the impact of PIs (for the patient and society); personal responsibility for PI prevention; and confidence in the effectiveness of prevention strategies. All items were rated on a forced choice four point Likert scale (1 strongly disagree to 4 strongly agree). The maximum total score for this section of the survey was 52, with a higher score meaning a more positive attitude to PU prevention and vice-versa. The cut-off point determining a positive attitude score was >70% (>36.4/50). The original instrument validation reported internal consistency with a Cronbach's alpha of 0.79, (Kaiser-Meyer-Oklin [KMO] = 0.72), and construct validity was statistically significant with Bartlett's test of sphericity ($\chi^2 = (78) 1062.6, p < 0.001$).¹⁵

The pressure ulcer barriers and facilitators tool (Schindler, 2010) was modified to suit an adult population.¹⁷ The original tool comprised of 25 items, however, two items were removed as the Sunrise pressure ulcer prevention nursing order set and the Braden Q risk assessment tool for pressure ulcer development were not used in the study ICU. Included were two open-ended questions and 21 items rated on an 11-point (0-10) rating scale where 0 = not at all: 12 items addressing barriers to PI prevention, seven items covering enablers of PI prevention, two items focusing on overcoming barriers and efforts for facilitating PI prevention practice.

The amalgamated tool comprised 36 items, plus six demographic questions. This combined instrument was previously tested for validity and reliability. Tayyib and colleagues (2016) reported content validity index of 0.97 and reliability with Cronbach's alpha coefficient of 0.85 achieved. Further, they assessed construct validity for the 13 items that queried potential barriers to optimal skin care (KMO 0.874, Bartlett's Test of Sphericity $\chi^2 (78) 573.18, p < 0.001$), and the seven items that queried facilitators to optimal skin care (KMO 0.78, Bartlett's Test of Sphericity $\chi^2 (21) 316.48, p < 0.001$).¹⁷ All of the above results demonstrate the structure of the questionnaire measures the intended outcome and measures this consistently, thus indicating sufficient validity and reliability of the survey.

Knowledge test

The test used was the Modified Pieper Pressure Injury Knowledge Test as adapted for use in the Australian acute care hospital context by Lawrence and colleagues (2015).¹⁸ Forty-nine items were

included in this instrument covering knowledge of PI prevention (33 items), PI staging (8 items), and wound description (8 items). Permission to use this instrument was obtained from the authors. Lawrence (2015) reports adequate content and face validity for the modified test but did not report reliability.¹⁸ The original Pieper Pressure Ulcer Knowledge test has reported reliability with a coefficient alpha of 0.85.¹⁹ The modified knowledge test consists of forty-nine statements about PI prevention, PI staging and wound description. Respondents rated the statements as “true”, “false”, or “don’t know”. The ‘don’t know’ category was included to identify RNs’ lack of knowledge as opposed to randomly guessed correct or incorrect responses.²⁰

Focus groups

The focus groups with exploratory open-ended questions were used to understand local contextual factors impacting the implementation of PI prevention strategies in the ICU. Focus group interviews commenced with the question; *what does good and consistent pressure injury prevention look like in the ICU?* Additional questions explored RNs understanding of staffing and workload as barriers and/or enablers to PI prevention and perceptions of skills and knowledge relating to PI prevention. For each response RNs were asked if they could expand on or describe their experiences in this area.

Procedure

Following ethical approval, ICU RNs were informed about the study at ward meetings, during in-services and via internal email correspondence prior to commencement of the study. Participation was voluntary.

Survey

The survey was administered electronically using Key Survey software between 27 May and 18 June, 2015. An email was sent via the electronic survey site with a link to the survey and the Participant Information Form outlining the study attached. Posters were erected at strategic points around the ICU to remind staff to access the email with the survey link. Information about the study and the survey was also added to the electronic staff notice board. For the duration of the survey reminder cards were

placed strategically in each bed space, either at the base of the computer screen or on the wall near a hand washing basin, to remind the RNs to complete the survey. A reminder email was sent to non-respondents through Key Survey before the final survey date. Approximately 10 minutes was required to complete the survey. Completion of the online survey was anonymous and submission signified consent.

Knowledge test

The knowledge test was administered to RNs before the commencement of the focus group. Participation in the knowledge test was voluntary. A Participant Information and Consent Form outlining the study was distributed to all RNs interested in undertaking the knowledge test. Registered nurses completed the test independently with no conferring or discussion.

Focus groups

The times and purpose of the focus groups were advertised on posters around the ICU and via email. Four focus groups were held in July 2015. Focus groups were approximately 30-40 minutes in length, with opportunity to run for longer if required, and were scheduled in the mid-afternoon in-service time at shift handover. All focus groups were conducted in a quiet meeting room in the ICU. A registered court reporter attended the focus groups and transcribed the focus groups discussions in real-time as voice to text using a stenotype shorthand machine. A Participant Information and Consent Form outlining the study was distributed to all RNs who then signed a consent form. Focus groups were conducted by two authors (FC, J-LC) who have ICU nursing experience but who had not worked clinically in the research site ICU.

Data analysis

Quantitative

For the survey and knowledge test, the data were entered and analysed using the Statistical Package for the Social Sciences (SPSS, version 23). Descriptive statistics were used with mean, standard deviation and range for continuous and ordinal data and counts and percentages for nominal data. Spearman's

correlation test was used to determine relationships between total attitude score and barrier and facilitator items and continuous variables within in the knowledge test. Mann-Whitney U test was used to assess knowledge test scores and education levels. *P* values of 0.5 or less were deemed to be significant.

The APuP instrument was scored using methods developed by the authors¹⁵. Here all 13 items were rated on a four point Likert scale (strongly disagree to strongly agree). The mean of each dimension was calculated where strongly disagree=1, disagree=2, agree=3 and strongly agree=4 for the six positive statements and strongly disagree=4, disagree=3, agree=2 and strongly agree=1 for the seven negative statements. The items were summarised as means.

Qualitative

For focus group data, thematic analysis was undertaken independently by two researchers (FC, J-LC) using the method outlined by Braun and Clark.²¹ The process involved six phases; becoming familiar with the data, generating initial codes, recognising themes, reviewing the themes, defining and naming the theme and producing the final report. The analytical process involved each researcher (FC, J-LC) individually reading and coding each focus group separately. Then, using a collaborative process, both researchers clustered codes into groups which had a similar meaning. The final stage of the analysis required the clusters to be categorised into larger conceptual groups which became the final themes. These themes were then evaluated for the most appropriate fit with the original data.

RESULTS

Sample

Fifty RNs participated in the PI prevention in ICU Survey; a response rate of 24.5%. The majority were female (82%) and held postgraduate qualifications (62%). Forty-six RNs undertook the PI knowledge test and then participated in focus groups. The majority were female (89%) and did not hold a postgraduate qualification (59%). A summary of RN demographic information is detailed in Table 1.

Survey

Most RNs had a positive attitude to the implementation of PI prevention strategies with a total mean score of 41 out of a maximum total of 52 (Table 2). Registered nurses considered PI prevention as a priority in their care of patients demonstrated by the high mean score of the Priority subscale. Most APuP instrument subscales were high in this study with the Impact subscale reporting the lowest result. The APuP instrument total correlated significantly with the item overcoming barriers in PI prevention item (Spearman's $r=0.430$, $p=0.002$), though there was no correlation with the efforts to facilitate PI prevention item (Spearman's $r=0.253$, $p=0.076$).

Registered nurses reported a moderate to high ability to rise above overall barriers in PI prevention. Table 3 lists this overall measure and twelve barriers to PI prevention which were scored by the RNs. These barriers can be classified into items which relate to the RN, items regarding staff attitudes, interventions and hospital environments items and patient and carer related elements. Personal barrier items were seen by the RN participant as easy to overcome. Staff and hospital items were recorded by the RNs as having a low to moderate impact on PI prevention, and finally patient and carer related items were seen as the most significant of these barriers in providing optimal skin care.

Efforts to enable the prevention of PIs overall within the ICU by RNs were recorded by the RNs as moderate to high (Table 3). Table 3 also summarises enablers to optimal skin care rated by the RNs. All items scored moderate to high with items on education for PI risk assessment and grading scoring the highest. Access to appropriate skin care products was also a high ranked facilitator in the prevention of PIs. Staff and hospital related items were viewed by RNs as moderate enablers.

Modified Pieper Pressure Injury Knowledge Test

Three statements achieved 100% correct responses with 41% of statements achieving more than 90% correct responses. Conversely, almost one fifth of the statements were answered correctly by less than 50% of RNs. Overall on average, the 46 RNs answered 76.6% (SD 7.32, range 57-89%) of statements correctly, 14.7% (SD 5.11, range 6-15%) of statements incorrectly and 9% (SD 7.12, range 0-25%) as did not know or were missing. Wound subscale items were less likely to be answered incorrectly with

proportionally higher did not know responses. Staging subscale items were more likely to be answered correctly (Table 4).

Registered nurses with postgraduate qualifications answered more statements correctly than those without (Median of 79.6% versus 75.5%, Mann-Whitney $U=142.5$, $p=0.023$). Older RNs were significantly less likely to mark statements as 'did not know' or 'missing' (Spearman's $r= -0.308$, $p=0.040$). Registered nurses with more years registered as a nurse also marked significantly fewer statements as did not know or missing (Spearman's $r= 0.468$, $p=0.001$) but significantly more statements as correct (Spearman's $r= 0.413$, $p=0.005$)

Focus Groups

Four focus groups were held with 9-14 RNs in each group. A total of 47 RNs participated in the focus groups. Four themes were identified; Team ICU, Processes of care, Education for consistency and The Patient (Figure 2). Table 5 depicts the themes, clustered codes and provides exemplar RN vignettes.

A major issue identified in the surveys was that of RN staffing, skill mix and workload and this was further explored in the focus groups. Registered nurses discussed how these factors either positively or negatively influence the success of PI prevention in the ICU. They acknowledged and appreciated the expertise contributed by all members of the ICU health care team including allied health, medical staff and patient support services, but expressed a desire to improve the contribution of these groups towards PI prevention. Hence, the first theme that emerged from the discussions was *Team ICU*. This theme is exemplified in table 5 and the following participant vignette:

Occupational therapy reviews are necessary to get things like pillows, heel wedges, all that extra equipment (FG 1, P12).

Processes of care was another theme that emerged in the focus group discussions. Advantages and shortfalls in the electronic clinical information system and patient incident reporting processes were key findings. The facilitation and sometimes dysfunction of patient repositioning, intended to occur every three hours, were a major process of care finding:

Turn rounds could be a lot better – no accountability for nursing staff who might not be ready or miss a turn. (FG 2, P6)

The need to improve education in PI risk assessment, staging and prevention arose in each focus group and led to the emergence of another theme, *Education for consistency*. There were positive and negative experiences raised depending on the participant's prior exposure to PI prevention educational strategies in the ICU. Shortfalls in education for PI prevention in orientation and use or knowledge of available equipment to prevent PIs was a key finding.

Lots of information in ICU orientation but pressure care not high in priorities – little information people could recall (FG 1, P1).

Finally, *The Patient* emerged as a mitigating factor in many RNs' approach to PI prevention. Patient acuity impacted on implementing appropriate PI prevention strategies when haemodynamic instability, frequent procedures and issues with cervical-spine clearance were evident.

The presence of devices, I guess, so arterial lines, central lines and devices that are attached to that, IDCs, [makes it] not hard to turn, I suppose, but they are an increased risk [with turning]. (FG 3, P1).

Further, this theme highlighted the impact of the patient's wishes and presence of relatives on the implementation of PI prevention strategies. This is illustrated in the following vignettes:

Sometimes patients decline [to be turned] and you try to encourage them. (FG 1, P7)

Sometimes difficult to get family to leave – they can get pretty upset. (FG 2, P3)

DISCUSSION

In Phase 1 of this study, 50 RNs completed the survey, 46 RNs completed a knowledge test and 47 RNs joined focus group interviews. Some RNs may have participated in all three modes of data collection while some RNs may not have participated at all. Registered nurse characteristics in this study demonstrated diverse levels of experience and qualifications. This study identified a range of tangible and intangible enablers and barriers to the delivery of appropriate and timely PI prevention strategies

in a tertiary ICU. A key strength of this study was the development of a strong understanding of contextual factors influencing clinical practice in this local setting. Developing an understanding local context is key success factor in research translation. Systematic delineation of barriers and enablers to the adoption of evidence-based interventions in a given practice setting assists in the active management of obstacles, and the harnessing of positive approaches to facilitate the adoption of the research intervention.²²

Enablers for PI prevention strategies

Overall, our findings highlight that RNs had a positive attitude toward PI prevention in the ICU. This is consistent with previous work in this area.⁸ Our findings also showed that RNs considered PI prevention to be a priority of care for critically ill patients. Conversely, Tayyib and colleagues (2016) identified PI prevention care as a low priority in RNs daily routine in the ICU.¹⁷ However, Tayyib's (2016) study was conducted in Saudi Arabia and it is possible that the different care context and culture may have resulted in the difference in findings.

A further enabler of PI prevention practices was RNs' satisfactory level of knowledge, both self-perceived, and demonstrated by the knowledge test. Registered nurses in the ICU have a responsibility to assess, identify, prevent and manage PI in critically ill patients. Therefore it is essential that their knowledge is evidence based and current. Our results for the knowledge test showed 41% of the items achieved more than 90% correct responses. This satisfactory level of knowledge is consistent with the work of Lawrence (2015) where just over half of the items (53%) were answered correctly by 90% of respondents.¹⁸ Further comparison with Lawrence's study is difficult as no specific data for RNs in the ICU was reported.¹⁸ The item which scored the lowest in our study related to 'patients confined to bed should be repositioned every three hours'. Only 6.5% of respondents answered this item correctly. We argue that this low result is attributable to the wording of the statement and that respondents may have interpreted three hour repositioning as not individualised to the patient's needs.

Education was identified in both the survey and focus groups as a key enabler to PI prevention practice. Pressure injury prevention practices are a fundamental component of nursing care. Thus, in order to optimise positive patient outcomes, it is imperative that all RNs receive evidence-based education on

skin assessment, PI risk assessment, PI staging and PI prevention strategies. Registered nurses in this study highly valued such education and felt there were efforts being made to facilitate their ability to prevent PI injury development in patients in the ICU.

Barriers to PI prevention strategies

Our survey results and focus group findings show that the individual patient's clinical condition was perceived as a major barrier to the implementation of PI prevention strategies. Preventing skin injury is a nursing responsibility and is considered a key indicator or outcome measure of quality of care.²³ However, care of the critically ill patient poses many challenges, particularly maintaining skin integrity. Critically ill patients can be considered at high to very high risk of PI development.⁴ It is important to note that there may be instances where the patient's clinical condition precludes repositioning. However, these cases are rare and may include conditions of extremely high patient acuity such as patients receiving extracorporeal membrane oxygenation therapy or cases of severe multiple trauma. Vollman argues that more commonly there is a perception held by the RN that the patient is unable to be repositioned.²⁴ This perception may be held for a variety of reasons such as haemodynamic instability, concern about the safety of multiple devices and also RN lack of confidence or lack of experience in repositioning critically ill patients.

Another identified barrier to evidence-based PI prevention practice, highlighted in both the survey results and focus group findings, was the issue of competing demands on RNs' time. This finding is not new.^{8,25} Pressure injury prevention practice may appear to be time consuming.²⁶ Our findings resonate with anecdotal reports of RN frustration about excessive documentation and subsequent lack of time for fundamental care practices. This problem can be at the forefront in the intensive care context when the patient's clinical condition directly overrides the delivery of fundamental care, including PI prevention. Bedside RNs are unable to change or influence patient acuity however, PI prevention remains an essential dimension of care of the critically ill individual.

This study identified that the whole of team or unit approach was seen by some RNs as a positive element which facilitated the implementation of PI prevention practices. Conversely, some RNs felt that staff attitudes in the ICU were a barrier to PI prevention practice. Although this study did not

examine work culture, it is apparent that RNs were divergent in their views of support received in the workplace to implement PI prevention strategies. Adequate staffing, satisfactory levels of staff knowledge and staff cohesion in all members of the ICU team, as well as a departmental or unit commitment to monitoring of care delivery, can contribute to the provision of high-quality preventative care.²⁷

Limitations

This study is limited in generalisability by the nature of the design employed; a survey, knowledge test and focus groups in a single setting. However, the methods employed were intentionally used to adequately describe the context in the ICU research site in order to facilitate the identification of targeted strategies for this ICU in subsequent phases of this study.

The low response rate to the online survey is a limitation of this study, and may be a reflection of how some RNs prioritise PI prevention. Further, at the conclusion of the survey period 70 RNs had accessed the survey without completing it, which may indicate interest in the survey, but competing priorities prevented completion.

Limitations of the focus group method used included pragmatic decisions about the length of time allocated to, and number of participants in, each focus group. This may have limited effective in-depth discussion of the issues. Secondly, the lack of collection of non-verbal data or field notes is acknowledged as a limitation. The groups' composition was such that members were known to each other, interacted in a cohesive manner and were participating in a discussion on an area of clinical interest. Further, both researchers (fc, J-LC) noted no overly shy or dominant RN focus group members. The court reporter provided real-time, accurate and impartial transcription of discussions.

CONCLUSION

The ICU is a unique clinical area with significant challenges. High patient acuity emerged as a significant barrier to implementing appropriate and timely PI prevention strategies in the ICU. Pressure injury prevention processes are generally addressed in the hospital-wide orientation but as identified, ICU is a unique clinical area with significant challenges. There seems to be a dichotomy between RNs

who believe the unit has a proactive and positive approach toward PI prevention, and those RNs that do not believe PI prevention receives the attention it warrants in the ICU. Increased visibility and role modelling of PI prevention and management strategies by experienced RNs could demonstrate the benefit of positive attitudes to PI prevention in the ICU.

ACKNOWLEDGEMENTS

We thank all RNs who participated in this phase of the study. This study was funded by a Research Implementation Fellowship from the XX.

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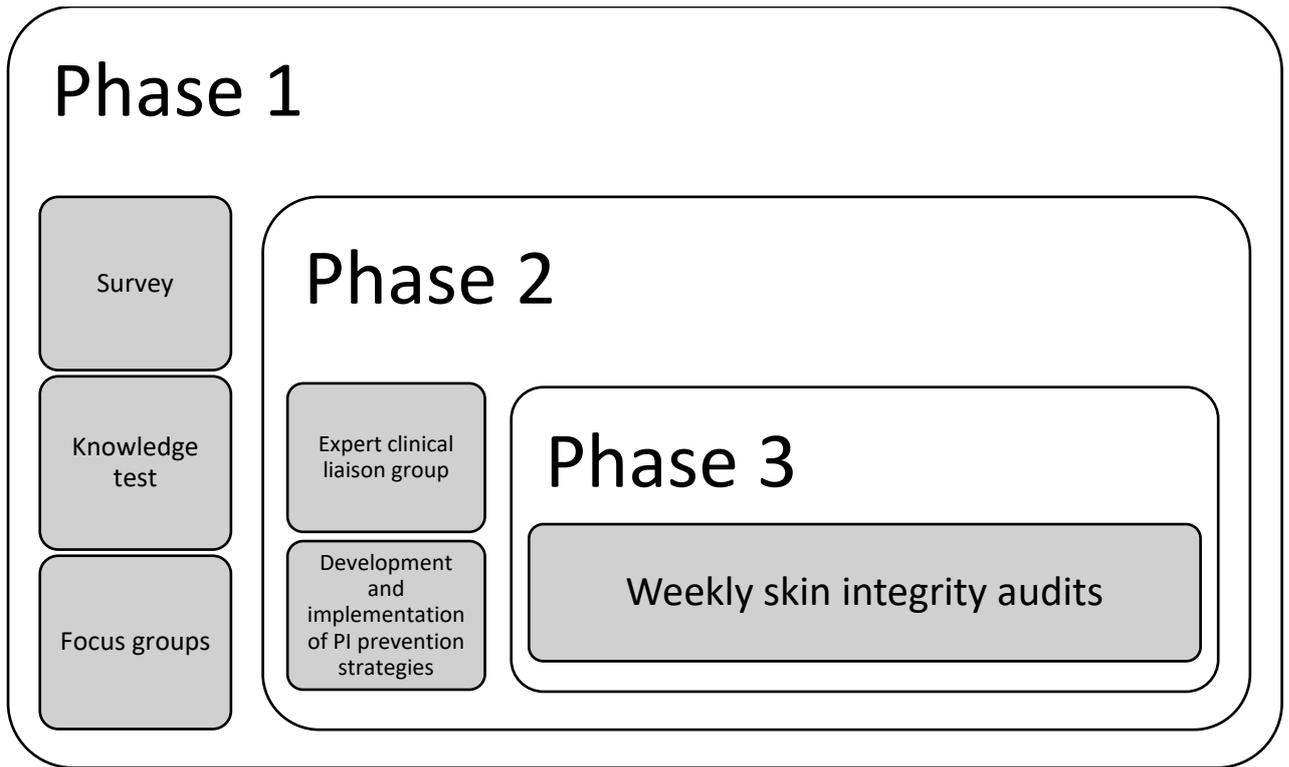


Figure 1 SUSTAIN study design

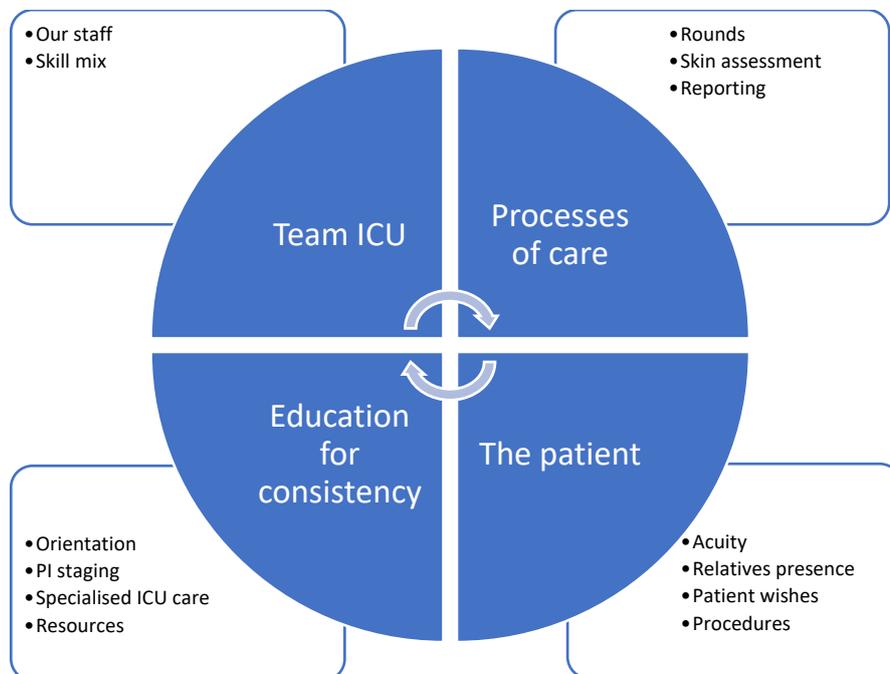


Figure 2 Focus group themes and clustered codes in the research site intensive care local context

Table 1. Demographic characteristics of study participants.

Survey Participant Characteristics (n=50)		
<i>Categorical Variables</i>	<i>n</i>	<i>Percentage</i>
Education (Postgraduate qualifications)	31	62
Sex (Female)	42	84
<i>Continuous Variables</i>		<i>Median (IQR)</i>
Age (years)		36.5 (29.0-41.3)
Years as a Registered Nurse		10.5 (3.8-16.5)
Years working within ICU		8.0 (1.0-21.6)
Years working within the hospital		4.0 (1.0-9.0)
Focus Group (n=47)* and Knowledge Test participant characteristics (n=46)		
<i>Categorical Variables</i>	<i>n</i>	<i>Percentage</i>
Education (Postgraduate qualifications)	19	41
Sex (Female)	41	89
<i>Continuous Variables</i>		<i>Median (IQR)</i>
Age (years)		30.0 (26.0-37.0)
Years as a Registered Nurse		6.0 (2.8-11.0)
Years working within ICU		2.0 (>1-7.5)
Years working within the hospital		4.0 (1.5-7.0)
IQR: Interquartile range		

* Missing data n=1

Table 2. Attitudes towards PI Prevention (n=50)

ATTITUDES	SD n (%)	D n (%)	A n (%)	SA n (%)	Mean *
<i>F1 Personal competency to prevent PIs (3 items, max score = 12)</i>					9.82
F1.1. (+) I feel confident in my ability to prevent PI	1 (2)	0 (0)	31 (62)	18 (36)	3.32
F1.2. (+) I am well trained to prevent PI	1 (2)	5 (10)	26 (52)	18 (36)	3.22
F1.3. (-) PI is too difficult. Others are better than I am	17 (34)	30 (60)	3 (6)	0 (0)	3.28
<i>F2 Priority of PI prevention (3 items, max score = 12)</i>					10.30
F2.1. (-) Too much attention goes to the prevention of PIs	18 (36)	28 (56)	3 (6)	1 (2)	3.26
F2.2. (-) PI prevention is not that important	37 (74)	12 (24)	1 (2)	0 (0)	3.72
F2.3. (+) PI prevention should be a priority	0 (0)	3 (6)	28 (56)	19 (38)	3.32
<i>F3 Impact of PIs (3 items, max score = 12)</i>					8.66
F3.1. (-) A PI almost never cause discomfort for a patient	36 (72)	13 (26)	1 (2)	0 (0)	3.70
F3.2. (-) The impact of PIs on a patient should not be exaggerated	8 (16)	18 (36)	19 (38)	5 (10)	2.58
F3.3. (+) The financial impact of PIs on the society should not be	9 (18)	17 (34)	20 (40)	4 (8)	2.38
<i>F4 Responsibility in PI prevention (2 items, max score = 8)</i>					6.28
F4.1. (-) I personally feel not responsible if a PI develops in my	13 (26)	23 (46)	11 (22)	3 (6)	2.92
F4.2. (+) I personally have an important task in PI prevention	0 (0)	1 (2)	19 (38)	30 (60)	3.58
<i>F5 Confidence in the effectiveness of PI prevention (2 items, max</i>					5.98
F5.1. (+) PIs are preventable in high-risk patients	3 (6)	14 (28)	28 (56)	5 (10)	2.70
F5.2. (-) PIs are never preventable	21 (42)	22 (44)	7 (14)	0 (0)	3.28
<i>Total Score (max score =52)</i>					41.04

*SD=Strongly Disagree, D=Disagree, A=Agree and SA=Strongly Agree.

Mean is calculated as SD=1, D=2, A=3 and SA=4 when statements are positive (+) and SD=4, D=3, A=2 and SA=1 when statements are negative (-).

Table 3. Profile of Barriers and Facilitators for PI Prevention (n=50)

BARRIERS	Category	Mean (SD)*
Low priority given to PI prevention by me	Personal	1.10 (1.42)
Limitations in my knowledge about PI prevention	Personal	1.64 (1.79)
Limitations in my ability to assess risk of PI development	Personal	2.06 (2.07)
Low priority given to PI prevention by nursing staff	Staff	2.38 (2.08)
Lack of authority to change patient care	Hospital	2.82 (2.34)
Current documentation format for PI risk / nursing interventions	Hospital	3.24 (2.62)
Insufficient resources to provide guidance / expertise in PI prevention	Hospital	3.42 (2.51)
Insufficient supplies / equipment to provide optimal PI prevention care	Hospital	3.64 (2.33)
Low priority given to PI prevention by medical staff	Staff	3.90 (2.66)
Low cooperation levels from patients or / and their family	Patient	3.92 (2.87)
Competing demands on my time	Hospital	5.06 (2.59)
Low priority given to PI prevention due to the severity of a patients illness	Patient	5.42 (2.26)
Overcome barriers in PI prevention	Overall	6.88 (2.13)
FACILITATORS	Category	Mean (SD)**
Current documentation format for PI risk / nursing interventions	Staff/ Hospital	5.28 (2.53)
Unit based skin integrity champion	Staff/ Hospital	5.88 (2.57)
Ease of obtaining pressure reduction surfaces	Interventions	6.36 (2.14)
Collaboration with interdisciplinary team (nursing/medical/pharmacy/dietary)	Staff/ Hospital	6.94 (2.05)
Education about risk assessment of PI development	Education	7.02 (2.35)
Education about PI grading	Education	7.42 (2.36)
Appropriate skin care products readily available	Interventions	7.52 (1.67)
Efforts to facilitate PI prevention	Overall	7.44 (1.73)
* Items have 11 points from 0 (<i>Not a barrier</i>) to 10 (<i>A major barrier</i>)		
** Items have 11 points from 0 (<i>Not at all helpful</i>) to 10 (<i>Very helpful</i>)		

Table 4. Results of the Knowledge Test (n=46)

Knowledge categories	Correct	Incorrect	Don't Know	Missing
Staging sub score (7 items, mean(SD))	84% (24.7)	15% (25.3)	1% (1.1)	0.6% (1.1)
Wound sub score (8 items, mean(SD))	77% (18.5)	8% (9.2)	15% (14.5)	1.1% (1.6)
Prevention sub score (34 items, mean(SD))	75% (27.4)	16% (21.4)	8% (12.1)	0.7% (1.3)
Total Knowledge score (49 items, mean(SD))	77% (25.5)	15% (20.5)	8% (21.1)	0.8% (1.3)

Table 5 SUSTAIN focus group themes, clustered codes and exemplar vignettes

Theme	Clustered codes	RN vignettes
Team ICU	Our staff	<p>“We used to have a float between – one for each pod, not a float for two pods. That makes it extremely difficult on a busy shift because they are caught up with [covering] breaks”. (FG 1, P14)</p> <p>“The person working next to you can’t give much help because their patient is ventilated as well, most of the time”. (FG 1, P10)</p> <p>“Have to have two nurses [to log roll a patient] and there is usually not enough people on the floor”. (FG 2, P1)</p> <p>“...depending on how many staff members are available because, if you have someone who has got a C-Spine turn, actually finding someone to do it [can be difficult if limited staff]”. (FG 3, P9)</p> <p>“[Turning a patient] has become much harder since having to share a Clinical Support RN between two pods”. (FG 2, P2)</p> <p>“Sometimes they start together and they go around together. Other times, they start in their own pods and do their pods together and you don’t know who does what. Sometimes they start later than what they are supposed to and sometimes they just don’t turn up”. (FG1, P1)</p> <p>“Lack of Wardies [<i>patient support officers</i>], especially on a weekend, trying to get a Wardsman... You can wait over an hour</p>

		<p>and then that has pushed you past when you are supposed to turn the patient”. (FG 1, P13)</p> <p>“....also get feedback from the Wardies, more communication to rationalise why [patient turn decision]”. (FG 4, P9)</p> <p>“Occupational therapy reviews are necessary to get things like pillows, heel wedges, all that extra equipment”. (FG 1, P12)</p> <p>“In our area, we have got a dietician who is there every day”. (FG 4 P4)</p> <p>“Patients who are unstable and you can’t roll them for medical reasons, in which case they will be on their back for a good part of the shift” (FG 2, P3) “... get the doctor to document it” (FG 2, P2) “....that we can’t roll them because they are unstable”. (FG 2, P3)</p> <p>“Delays getting C-Spine clearance because you need a senior radiographer and a senior ICU Consultant [so unable to turn patients]”. (FG 2, P10)</p>
	Skill mix	<p>“Difficult to make decision to turn and junior staff hopefully ask for help”. (FG 1, P14)</p> <p>“There is a doctor’s order not to turn them overnight.....due to differing levels of staff and their potential. So that’s not common but it does happen”. (FG 4, P11)</p> <p>“Some of them [<i>wardsmen</i>] are scary to turn. Some of them I would not want turning me”. (FG1, P6)</p>
Processes of care	Rounds	<p>“Turn rounds could be a lot better – no accountability for nursing staff who might not be ready or miss a turn”. (FG 2, P6)</p> <p>“Bringing in turn rounds has been beneficial but we could implement them a lot better – would be good to send a support person around with the Wardies to help – staffing limitations prevent it”. (FG 4, P10)</p>

		<p>“I find the PUP [<i>Pressure ulcer prevention or Skin Integrity</i>] rounds are really useful. I am also fairly new”. (FG 1, P1)</p> <p>“[Weekly Skin Integrity Rounds are very helpful but it is hard with the shifts because you might only see one every month, every two months, if you are lucky”. (FG 2, P10)</p> <p>“Timing of medical ward rounds not conducive to pressure injury prevention interventions”. (FG 1, P5).</p>
	Skin assessment	<p>“Theoretically, you go through the patient [<i>skin</i>] assessment. You just need to check it [<i>electronic assessment documentation / Waterlow Score</i>] and make sure it has been updated. Even though it says it’s only meant to be done once on admission, the policy actually says it’s meant to be done once a week as well, or as deterioration occurs, so it is never updated”. (FG 2, P4)</p> <p>“[<i>Need to</i>] promote ongoing assessment around devices”. (FG 4, P12)</p>
	Reporting	<p>“That’s why it is important to PRIME[*] any injuries that come with the patient because, if it develops into a stage three, we can say, well, they came – some old lady has been lying at home for three days. This wasn’t something that we did; it has come from that”. (FG 3, P4)</p> <p>“...we could do that [<i>documentation</i>] so much better within the ‘WoundMan’[**], and also just under the daily observations when they write up their notes at the end of the day to say ‘skin intact’. It doesn’t really mean anything”. (FG 3, P3)</p> <p>“[<i>PRIME</i>] quite difficult, very labour intensive unless you know some of its particulars...”. (FG 4, P1)</p> <p>“[<i>There is a</i>] disconnect between an actual pressure area that develops with a patient and what happens with the paperwork, the data, the pressure area continuum.... you need feedback mechanisms”. (FG 4, P1)</p>

Education for consistency	Orientation	<p>“Lots of information in ICU orientation but pressure care not high in priorities – little information people could recall”. (FG 1, P1).</p> <p>[<i>PI prevention in orientation</i>] ...is mentioned but there is no specific package”. (FG1, P6)</p>
	PI Staging	<p>“I would really like education on the stages of pressure injuries” (FG 2, P1) “...university focuses on normal wards. It is pretty different here. It is a bit more important here because of the state of our patients”. (FG 2, P6)</p> <p>“Wards have got signs up and pictures [<i>on PI staging</i>] and there are no pictures here [in ICU]”. (FG 2, P4)</p>
	Specialised ICU care	<p>“I have been here for about four months and there are a couple of things I have picked up along the way I didn’t know I was meant to do, like collar cares and that type of thing. You just find out as you go. Maybe someone could do an in-service on it”. (FG1, P1)</p> <p>“Classify who is more prone to PI and needs more care in each aspect – nutritional, evaluation of skin care, what their condition is etc...” (FG 3, P5)</p> <p>“[<i>I would like</i>] a bit more education on the actual positioning of the patients. We all roll our patients but we often forget to elevate their arms or their heels... having the proper OT cushions [<i>would be good</i>]”. (FG 2, P3)</p> <p>“...we were actually doing really good half turns on patients as well, getting them right off their backs, and I think they have slowly progressed back to just doing the cushions under”. (FG 4, P4)</p>
	Resources	<p>“Some really obese patients benefit to have the small triangle wedge to help them turn on the side properly, or immobile patient; maybe we can help with the wedge”. (FG 2, P9)</p>

		<p>“We don’t have a great selection of dressings for ICU I just think maybe a bit more choice of dressings”. (FG 2, P10)</p> <p>“I think it would be good to have more education about wounds in compliance with ‘WoundMan’ [**] or the drop-down menus”. (FG 3, P2)</p>
The patient	Acuity	<p>“If the patient is very unwell and you are having a real busy time just getting the basics done”. (FG 2, P2)</p> <p>“Probably time and the severity of illness of the patient. Sometimes patients are too ill to turn or their co-morbidities or their injuries prevent being moved to a certain position or a certain way”. (FG 3, P2)</p> <p>“The presence of devices, I guess, so arterial lines, central lines and devices that are attached to that, IDCs, <i>[makes it]</i> not hard to turn, I suppose, but they are an increased risk <i>[with turning]</i>”. (FG 3, P1)</p>
	Relatives presence	<p>“Presence of family can be a barrier, especially those situations where you are actively withdrawing care from the patient”. (FG 2, P2)</p> <p>“Sometimes difficult to get family to leave – they can get pretty upset”. (FG 2, P3)</p>
	Patient wishes	<p>“Sometimes patients decline <i>[to be turned]</i> and you try to encourage them”. (FG 1, P7)</p> <p>“Patient lack of compliance – returning to previous position when turned”. (FG 3, P6)</p>
	Procedures	<p>“Sometimes it <i>[PI care]</i> can be delayed with whatever is going on with the patient, if you are doing lines or all sorts of things like that”. (FG 1, P1)</p>

* PRIME is the local clinical patient adverse event reporting system. It is not an acronym.

** WoundMan is part of the clinical information system where the location, type, severity and management strategies of wounds are recorded.