

**Title: Can a complex online intervention improve cancer nurses' pain screening and assessment practices? Results from a multi-centre pre-post test pilot study.**

Jane L. Phillips<sup>1</sup>, Nicole Heneka<sup>1</sup>, Louise Hickman<sup>1</sup>, Lawrence Lam<sup>1</sup>, and Tim Shaw<sup>2</sup>

<sup>1</sup>University of Technology Sydney; <sup>2</sup>University of Sydney

Address correspondence to:

Prof Jane L. Phillips,

University of Technology Sydney,

Centre for Cardiovascular and Chronic Care,

Level 3, 235 Jones Street, Ultimo,

PO Box 123, Ultimo, Sydney, NSW 2007, Australia.

E-mail: jane.phillips@uts.edu.au

Author Copy

## **Abstract**

### **Background**

Unrelieved cancer pain impacts adversely on quality of life. While routine screening and assessment forms the basis of effective cancer pain management, it is often poorly done contributing to the burden of unrelieved cancer pain.

### **Objectives**

To test the impact of an online complex evidence based educational intervention on cancer nurses' pain assessment capabilities; and adherence to cancer pain screening and assessment guidelines.

### **Methods**

Specialist inpatient cancer nurses in five Australian acute care settings participated in an intervention combining an online spaced learning cancer pain assessment module with audit and feedback of pain assessment practices. Participants' self-perceived pain assessment competencies were measured at three time points. Prospective consecutive chart audits were undertaken to appraise nurses' adherence with pain screening and assessment guidelines. The differences in documented pre-post pain assessment practices were benchmarked and fed back to all sites post intervention. Data was analysed using inferential statistics.

### **Results**

Participants who completed the intervention (n=44) increased their pain assessment knowledge, assessment tool knowledge, and confidence undertaking a pain assessment ( $p < 0.001$ ). The positive changes in nurses' pain assessment capabilities, translated into a significant increasing linear trend in the proportion of documented

pain assessments in patients chart at the three time points ( $\chi^2$  trend =18.28, df=1,  $p<0.001$ ).

### **Conclusion**

There is evidence that learning content delivered using a spaced learning format, augmented with pain assessment audit and feedback data, improves inpatient cancer nurses' self-perceived pain screening and assessment capabilities and strengthens cancer pain guideline adherence.

**Keywords:** Cancer Care Facilities; Education, Professional; Nursing; Intervention Studies; Learning; Nurses; Nursing; Pain Assessment; Oncology Nursing; Translational Medical Research.

### **What is already known about this topic**

- Cancer pain will affect the majority of cancer patients at some point in their illness trajectory.
- Cancer pain often goes under-recognized and under-treated due to nurses' failure to routinely screen, comprehensively assess and reassess pain.
- Although numerous cancer pain education interventions have targeted nurses, none have focussed on cancer pain assessment as a stand-alone learning component or have used evidence based pedagogy.

### **What this paper adds**

- Emphasising pain assessment as a distinct but essential element of pain management is crucial to improving cancer pain outcomes.
- Implementing evidence based educational interventions offers the best potential for changing clinical practice.
- Utilizing a scalable online spaced learning platform allows for the delivery of learning content that mimics clinical decision making and offers the potential of changing entrenched clinical practices.

## **Introduction**

Cancer pain is a debilitating symptom experienced by 30–75% of cancer patients (van den Beuken-van Everdingen et al., 2007). Nearly half (40–50%) have moderate to severe cancer pain, while more than a quarter (25–30%) have severe pain (van den Beuken-van Everdingen et al., 2007). Variations in care contribute to cancer pain being under-recognized and under-treated in 50% of patients (van den Beuken-van Everdingen et al., 2007). Many people with cancer experience more than one pain and some pains are associated with other co-morbid conditions. Cancer pain often persists long after all cancer treatment has ceased (Foley, 2011) and is almost always present during the final months of life (Herr et al., 2010). International and national cancer pain guidelines recommend a range of actions to address this known clinical practice gap that are achievable with minimal investments, but require practice changes (Dy et al., 2008; Foley, 2011). Fully implementing the evidence we have today would significantly reduce the burden of unrelieved cancer pain (Institute of Medicine, 2011).

The subjective nature of pain makes patient reported outcomes the optimal source of information and pursuing this information improves nurses' understanding of their patients' pain experience (Gordon et al., 2005). However, instead of seeking a numerically rated pain score (NRS), nurses often adopt informal screening approaches (Kerns, Otis, Rosenberg, & Reid, 2003) and neglect to document the patient's reported pain intensity score. When pain is detected, few nurses proceed to comprehensively assess the patient's pain (Franck & Bruce, 2009; Miaskowski, 2010).

In the USA, pain is considered the fifth vital sign, with the right to appropriate pain assessment and management embedded in hospital accreditation standards (Berry & Dahl, 2000). These standards require clinicians to systematically screen for pain, with the presence of pain prompting a comprehensive pain assessment (Dy et al., 2008; Idell, Grant, & Kirk, 2007) which determines: location, temporal pattern(s), identification of treatment and exacerbating and/or relieving factors; and whether the pain is nociceptive or neuropathic in origin (Holen et al., 2006). Notwithstanding this complexity, few nurses have been formally taught how to assess these pain domains, with most learning done 'on the run' or by observation of their peers. This knowledge gap has led to calls for the integration of comprehensive interprofessional pain curricula for all undergraduate health students and strengthening of pain education opportunities for existing clinicians (International Association for the Study of Pain, 2012). Internationally, evidence of screening and assessment practices are increasingly being recognized as quality indicators of optimal cancer pain management (Dy et al., 2008). In Australia, specialist palliative care services are routinely required to capture the daily average pain intensity scores of inpatients and during every home visit for community patients, while there is no such obligation for cancer services (Pidgeon et al., 2015). However, a study conducted within one large Australian specialist palliative care service found little documented evidence of either routine pain screening and/or comprehensive pain assessments being routinely undertaken when pain was identified (Phillips & Piza, 2010). A consumer survey involving 13 different Australian palliative care services confirms this observation, with 35% of patients reporting having moderate-severe pain which restricted their activity over the preceding three days (Palliative Care Outcomes Collaboration, 2012). Similar results have been reported in the most recent consumer survey (Pidgeon et al., 2015). So even within specialties, where pain management is a core

competency, there are opportunities to improve the pain outcomes for patients by strengthening nurses' routine screening and pain assessment capabilities.

Nurses' failure to routinely screen, undertake a comprehensive pain assessment, implement appropriate management and regularly re-assess pain, impacts adversely on cancer patients and their families health related quality of life, sleep, ability to work and social interactions. As front-line health professionals, nurses play a crucial role in improving patient's cancer pain outcomes. Cancer patients are dependent upon nurses' recognizing, assessing, quantifying and communicating findings to other members of the interdisciplinary team (Fishman et al., 2013).

Changing behavior in dynamic clinical environments is challenging. A range of predisposing, enabling and reinforcing factors are known to shape nurses' pain assessment practices. Nurse's pain assessment competencies (Herr et al., 2010), their understanding of suitable assessment tools, their commitment and capacity to integrate pain assessment findings into clinical decision making (Luckett et al., 2014), communication skills and capacity to address their patients' care needs within the context of multi-professional practice (Carr, Brockbank, & Barrett, 2003; Fishman et al., 2013) all impact on patient reported pain outcomes. Interventions targeting nurses' cancer pain management practices have had varying degrees of success (Cummings et al., 2011; de Rond, de Wit, van Dam, & Muller, 2000; Ger et al., 2004; McDonald, Pezzin, Feldman, Murtaugh, & Peng, 2005). A review of clinical interventions directed at improving the treatment of cancer pain across units concluded that, while professional knowledge and attitudes about pain and nursing pain assessment rates are improvable, no hospital-wide intervention has been effective in reducing pain severity (Goldberg & Morrison, 2007).

While numerous cancer pain education interventions have been implemented for nurses (de Rond et al., 2000; Ger et al., 2004; McDonald et al., 2005), none have targeted cancer pain assessment as a distinct and separate learning component. Most education interventions have embedded cancer pain screening and assessment into a broader pain management learning package (Franck & Bruce, 2009). Improvement interventions are largely shaped by intuition derived from experience, which in part explains their ad hoc success and limited transferability (Davidoff, Dixon-Woods, Leviton, & Michie, 2015). These results suggest that there are opportunities to maximize the impact of the behavioral change intervention by including evidence-based strategies.

### **Theories informing the intervention design**

The Medical Research Councils Complex Interventions Framework (2000) guided the intervention development. During the planning (pre-clinical) phase an environmental scan identified poor adherence with recommended pain screening and assessment practices but opportunities for improvement given the imminent release of the evidence based Australian Adult Cancer Pain Guidelines (2013). Despite healthcare organizations making significant annual investments to build workforce capabilities, it is uncommon for workplace continuing professional development activities to be underpinned by evidence-based pedagogy. There is now good evidence that learning encounters which are ‘spaced’ and ‘repeated over time’ (spaced learning) result in more efficient learning and improved retention compared to the traditional bolus distribution learning format (Kerfoot, 2008; Kerfoot, Lawler, Sokolovskaya, Gagnon, & Conlin, 2010). When delivered prospectively, spaced learning generates significant topic-specific knowledge Kerfoot, Fu, et al. (2010).



Spaced learning is one of the few evidence based pedagogies which has been demonstrated in more than 12 randomized control trials to have increased clinicians' knowledge in specific domains and changed behavior (Kerfoot, 2010; Kerfoot, Armstrong, & O'Sullivan, 2008; Kerfoot & Baker, 2012; Kerfoot & Brotschi, 2009; Kerfoot, DeWolf, Masser, Church, & Federman, 2007; Kerfoot, Fu, et al., 2010; Kerfoot et al., 2011; Kerfoot, Kearney, Connelly, & Ritchey, 2009; Kerfoot, Lawler, Sokolovskaya, Gagnon, & Conlin, 2009; Kerfoot, Lawler, et al., 2010; Kerfoot, Turchin, Breydo, Gagnon, & Conlin, 2014; Shaw, Long, Chopra, & Kerfoot, 2011; Shaw et al., 2012). Spaced learning differs significantly from other pedagogies, as it 'pushes' short clinical case based scenarios, which take less than 5 minutes to answer, to participant's email or hand-held mobile device. A small number of cases are sent every other day. Upon answering a question, participant's performance is compared to their peers' de-identified responses, and they are provided with succinct feedback and links to relevant evidence-based resources and decision supports. The online spaced learning cancer pain assessment module is delivered via the automated 'QStream'<sup>TM</sup> internet platform.

Comprehensive interventions are more effective at addressing patients' pain, especially when documentation and monitoring interventions are combined (Allard, Maunsell, Labbe, & Dorval, 2001). More intense interventions involving extensive follow-up, a comprehensive educational program, and higher resource allocation are also significantly more likely to impact positively on reducing cancer pain (Cummings et al., 2011). Evidence based strategies, such as audit and feedback, which includes any summary of clinical performance over a defined period, can lead to potentially important improvements in practice (Ivers et al., 2012).

The COM-B (Capability, Opportunity, Motivation – Behavioral) System Framework was applied to better understand and target the desired behavior change (Michie, van Stralen, & West, 2011). The premise of COM-B Systems Framework is that capability, opportunity and motivations interact to generate the desired clinical behavior.

### **Objectives**

The objectives of this study were to: test the impact of a complex evidence based cancer pain educational intervention on inpatient cancer nurses' pain assessment capabilities; and determine if the intervention increased cancer nurses' adherence to Australian cancer pain screening and assessment guideline recommendations.

### **Methods**

Design: A pre-post-test study design was utilized for this study. The results reported conform to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement (von Elm et al., 2007).

Setting: Five Australian cancer services in metropolitan and rural New South Wales, including: two principal referral hospitals, a tertiary referral hospital, and two major hospitals (group 1 and group 2) (Australian Institute of Health and Welfare, 2015), within one translational cancer research network.

## **Participants**

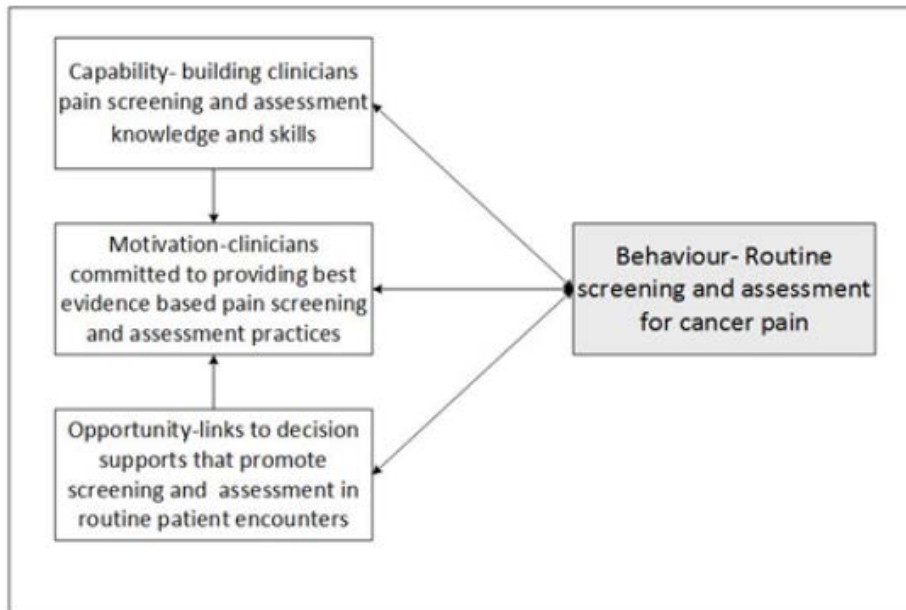
All registered and enrolled nurses (nurses) employed for more than 16 hours per week (n=208) within the five participating acute care hospitals providing inpatient and ambulatory cancer care were invited to participate in mid-2013. Email invitations were sent to all nurses who met the eligibility criteria by their nursing unit managers. Eligible nurses who decided to participate emailed the project co-ordinator directly.

## **Ethics**

Written informed consent was obtained from all participants in accordance with the ethical approval secured from each relevant health service and university human ethics research committees [HREC ref no: 12/165 - HREC/12/POWH/308].

## **Conceptual framework**

The COM-B System Framework assisted in identifying strategies to strengthen nurses' cancer pain assessment practices (Refer Figure 1). During this process we identified that nurses' *capabilities* include having the necessary knowledge and skills to routinely screen for pain and to proceed to complete a comprehensive pain assessment, if the patient reports a NRS pain  $\geq 3$ . *Motivation* energizes and directs their behavior, including conscious decision-making about routine screening and assessing, making cancer pain screening and assessment possible. *Opportunity* includes all factors that lie outside of the individual that prompt nurses to make cancer pain screening and assessment possible (access to online decision prompts and strategies for integrating pain assessment into usual care).



**Figure 1: Applying the COM-B System to the problem**

### **Intervention**

An inter-professional expert panel developed the online spaced education learning module. This educational content was tested with a small number of nurses before its subsequent piloting. The first pilot conducted with specialist palliative care nurses confirmed feasibility and acceptability of the intervention and study design, and allowed for refinement of the outcome measure .

The application of the COM-B System Framework shaped the elements included in this complex evidence-based educational intervention. The spaced learning pedagogy (11 case based cancer pain assessment scenarios) was augmented with a targeted behavioral change strategy (audit and feedback of cancer pain assessment practices at each site) (Ivers et al., 2012; Phillips, Heneka, Hickman, Lam, & Shaw, 2014) and supported by the release of the Australian Cancer Pain Guidelines (2013). It was anticipated that intergating these elements would strengthen the intensity (dose) of

this complex evidence-based educational intervention and impact positively on cancer nurses' pain assessment practices.

### ***Spaced learning case scenarios***

Eleven case based cancer pain assessment scenarios were delivered directly to consenting participants' email in a spaced, repeated and tested format over 28 days (Phillips et al., 2014). Case topics included: pain assessment on admission to the service; pain reassessment; undertaking a comprehensive pain assessment; communicating assessment findings at handover; assessing different pain types, e.g., neuropathic, nociceptive pain; and respecting patient preferences and values (refer Textbox 1). Participants could complete each cases in a location and time of their choice. Progressing through the learning module was dependent upon answering each case sequentially. No new cases were sent until the preceding case had been answered. The spaced learning methodology provides a high degree of fidelity as all participants receive the same learning content and delivery method.

### ***Audit and feedback***

An assessment of each sites adherence with the Australian Cancer Pain Guidelines (2013) recommended pain screening and assessment practices was undertaken pre and post intervention. At the completion of the survey data collection (Time 3 as described below), the de-identified pre-post intervention pain screening and assessment adherence data was reported back to each participating department via a written report and an on-site presentation, in accordance with recommended practice (Ivers et al., 2012). A lead clinical nurse academic (JP) facilitated the face-to-face audit and feedback sessions, providing participating departments with their benchmarked data and suggested actions to strengthen their cancer pain assessment practices.

<p><b>Domain 1: Multidimensional nature of pain - What is pain?</b></p> <p><i>Focuses on the fundamental concepts of pain including the science, nomenclature, and experience of pain, and pain's impact on the individual and society.</i></p>
<p><b>Clinical scenarios:</b></p> <ul style="list-style-type: none"> <li>- Differentiating types of pain</li> <li>- Nociceptive versus neuropathic pain</li> </ul>
<p><b>Domain 2: Pain assessment and measurement - How is pain recognized?</b></p> <p><i>Relates to how pain is assessed, quantified, and communicated, in addition to how the individual, the health system, and society affect these activities.</i></p>
<p><b>Clinical scenarios:</b></p> <ul style="list-style-type: none"> <li>- Pain assessment on admission to the service</li> <li>- Pain reassessment</li> <li>- Undertaking a comprehensive pain assessment</li> <li>- Documenting pain assessment findings</li> </ul>
<p><b>Domain 3: Management of pain - How is pain relieved?</b></p> <p><i>Focuses on collaborative approaches to decision-making, diversity of treatment options, the importance of patient agency, risk management, flexibility in care, and treatment based on appropriate understanding of the clinical condition.</i></p>
<p><b>Clinical scenarios:</b></p> <ul style="list-style-type: none"> <li>- Involving the patient and family/caregiver in pain management</li> <li>- Managing mild to moderate pain</li> </ul>
<p><b>Domain 4: Clinical conditions - How does context influence pain management?</b></p> <p><i>Focuses on the role of the clinician in the application of the competencies developed in domains 1–3 and in the context of varied patient populations, settings, and care teams</i></p>
<p><b>Clinical scenarios:</b></p> <ul style="list-style-type: none"> <li>- Accessing guidelines for cancer pain management</li> <li>- Pain management in palliative care settings</li> <li>- Communicating pain assessment findings during patient handover</li> </ul>

**Textbox 1: Cancer pain assessment scenarios and alignment with Core**

**Competencies for Pain Management domains (Fishman et al., 2013)**

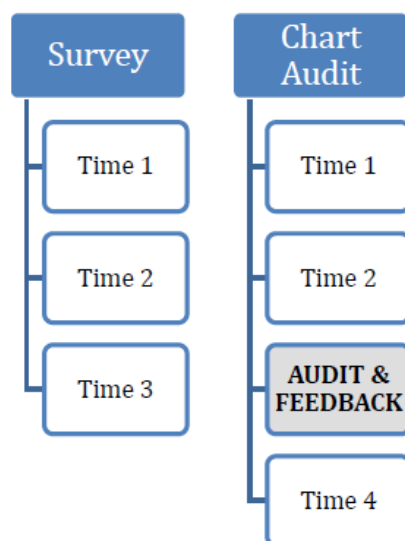
## Variables

This intervention aimed to increase inpatient cancer nurses' pain assessment capabilities and adherence to the Australian Cancer Pain Guidelines (2013) recommended pain screening and assessment recommendations.

## Data collection

Survey (participant) and chart audit (patients) data was collected at three time points over the 41 week study period:

- Time 1 (baseline) (T1): Immediately prior to the online module (intervention) commencing (participant survey and chart audit data);
- Time 2 (T2): Immediately following the completion of the intervention at each site (participant survey and chart audit data);
- Time 3 (T3): 10 weeks after the completion of the intervention (participant survey data only), plus T1-T2 chart audit data fed back to sites; and
- Time 4 (T4): One month after audit feedback (chart audit data only) (Refer Figure 2).



**Figure 2: Overview of pre-post-test data collection time points**

## Data Sources

### *The Self-Perceived 'Pain Assessment Competencies' (Self-PAC) Scale*

An exhaustive search of the literature failed to identify a suitable instrument that appraised nurses' cancer pain assessment competencies. Competencies in the context of this study referred to nurses' perception that they had sufficient knowledge and skills to assess patients' cancer pain. An interprofessional expert panel was convened to develop a suitable measure based on the Australian Cancer Pain Guideline (2013) recommendations. Panel members were invited to rate on each item in each domain with a 5-point Likert rating scale for its suitability to be included in the scale. Any items with an average rating of less than 3 were discarded with the remaining items subjected to further analysis. Three domains were identified as being important for appraise cancer nurses' perceived pain assessment knowledge and confidence: cancer pain assessment knowledge; pain assessment tool knowledge and confidence to undertake a cancer pain assessment (Phillips et al., 2014).

The 17 item Self-PAC Scale includes several demographic questions (i.e. age, gender, roles, clinical experience and post-graduate education) and a series of pain assessment knowledge, pain assessment tool knowledge and pain assessment confidence questions. An 11 point visual analogue rating scale, 'no knowledge/not confident' (0) through to 'extensive knowledge and extremely confident' is used (10). The Self-PAC Scale has undergone preliminary validation. It has acceptable face validity, internal consistency, reliability psychometric properties for its three subscales: pain assessment knowledge, pain assessment tool knowledge and pain assessment confidence (Phillips et al., 2014). All consenting participants completed the Self-PAC Scale at baseline (T1) and again at two additional time points (T2 and T3).



### ***Chart audit data***

The medical records of all patients with cancer related pain admitted to the participating units during a defined four week audit period were reviewed. Inpatients were excluded if the patient was discharged and/or died within 48 hours of admission and there was no documented evidence that the patient had pain on admission, developed pain during admission or experienced pain up to the audit date. As patients are cared for by multiple nurses each day, all pain assessment documentation in patients' medical chart was matched to intervention participants or non-participants. All chart audit abstractions were undertaken by a trained research assistant (NH) using a case report form, supported by a data dictionary. This process ensured standardized audit data collection at all sites and reconciliation of recommended and actual pain screening and assessment actions, and who initiated them.

Prospective consecutive chart audits were completed at three *a priori* time points to measure nurses' adherence with recommended Australian Cancer Pain Guidelines (2013) pain assessment recommendations. Nurses were unaware of the designated audit periods.

### **Bias and study size**

Personal login and password were issued to each participant to facilitate their access to the online spaced learning platform. As the sample size was considered to be too small to undertake a randomized control trial (RCT), a quasi-experimental design was implemented. To minimize bias, the chart audit period inclusion dates were blinded to all participants and managers.

## **Data analysis**

Statistical analyses were performed using SPSS software V20. Descriptive analyses were applied to all variables of interest and the outcomes. The mean scores obtained from the survey before and after the intervention were compared using the repeated measures general linear model. A type one error rate of 5% ( $p$ -value of .05 or smaller) was adopted to refute the test hypotheses. The 95% Confidence Intervals (95% C.I.) of the differences were also calculated.

Trend analysis was applied to test for any linear trend in the proportions of documented pain assessments across time on admission as well as in the 24 hour audit period. For the quality of the pain documentation recorded in the medical notes, a quality score was calculated using 8 comprehensive pain assessment documentation items, including: documented pain score, location, radiation, aggravating factors, alleviating factors, quality, severity, and timing. One point was assigned to each comprehensive pain assessment item documented in the patient's medical records, when screened positive for pain. A summative quality score out of eight was then calculated to represent the total amount of comprehensive pain assessment information recorded, with 0=no items documented and 8= all items documented. A higher quality score represent a larger amount of comprehensive pain assessment information recorded, whereas a lower quality score represents less comprehensive pain assessment information. A quality score was calculated for each audited record across time. Owing to the highly skewed distribution of the quality scores across time, a non-parametric approach of Kurskal-Wallis H test was applied to examine the equality of the median quality score across time.

## **Results**

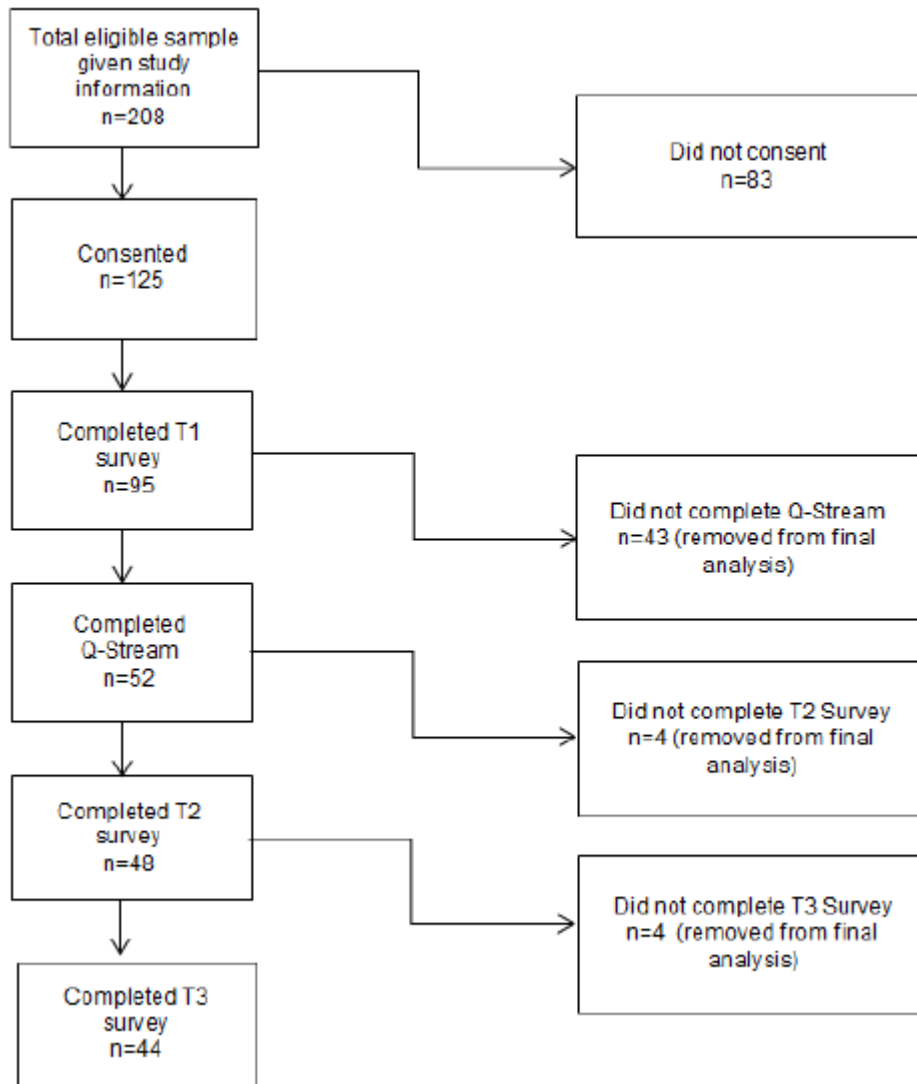
### *Participants*

The participant flow is outlined in Figure 3. Just over half (n=52, 54%) of the participants who enrolled in the study (n=95) subsequently completed the baseline survey (T1), the online pain assessment learning module ('intervention'), T2 (n=48, 92%) and T3 surveys (n=44, 91%). During the study period 12 participants left the workplace. The final survey analysis sample is based on the 44 participants who completed the survey at all three time-points. The participants' who completed the baseline survey but failed to complete the intervention (n=43) are classified as 'non-participants'.

The participants who completed the intervention (n=52) answered all 11 case studies (100% engagement). Learning module proficiency data, generated from the intervention platform, showed that 88% of these participants correctly answered the case study questions on the first attempt.

### *Recruitment rates*

All five cancer services within the translational cancer research network agreed to participate in the study. Participating cancer services encompassed inpatient, ambulatory and community outreach care, however, all study participants were based in inpatient oncology services despite active recruitment across all service types. The recruitment to completion rates varied across the sites from 12 to 61%, with the highest level of completion occurring in the group 2 major hospital.



**Figure 3: Study participant flow**

### **Descriptive data**

The majority of participants were female (87%), registered nurses with a bachelor's degree (57%) with a median age of 33.5 years. While most (43%) had been working in nursing between 6-15 years, just under two thirds (61%) had made the transition to cancer nursing in the last five years. There was no statistical difference between the participants and non-participants in terms of their: age ( $\chi^2_2=4.59, p=0.101$ ), years of

nursing ( $\chi^2_2 = 2.88, p=0.23$ ), cancer nursing ( $\chi^2_2 = 5.4, p=0.067$ ) and frequency of undertaking a cancer pain assessment ( $\chi^2_2 = 0.492, p=0.78$ ).

### Survey

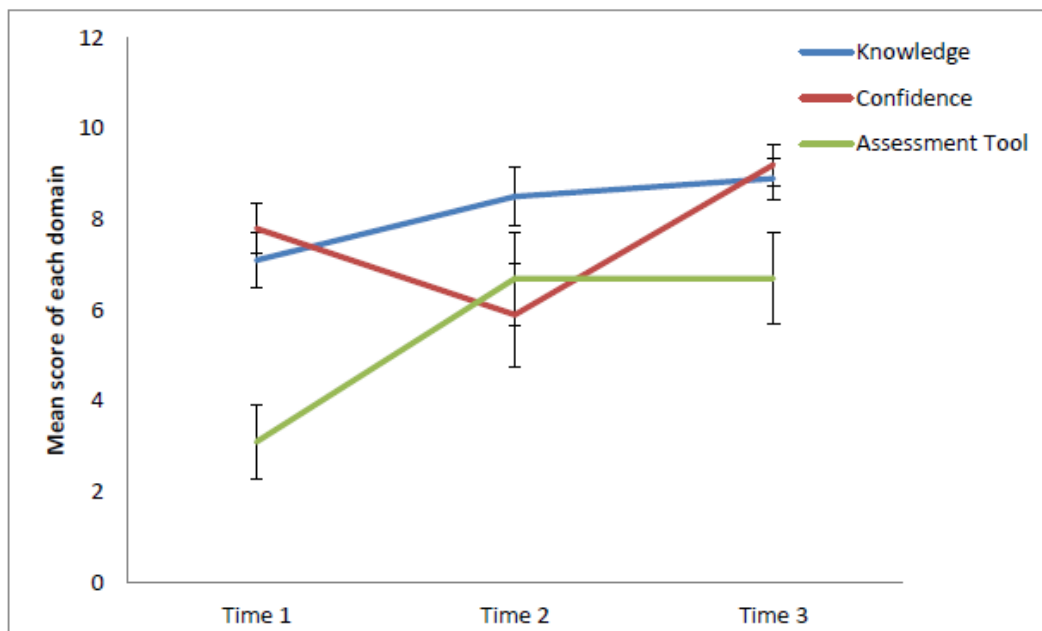
There were significant differences in the mean perceived pain assessment knowledge scores across time ( $F_{(2, 35)}=31.92, p<0.001$ ), with a mean T2 score of 8.5 (s.e.=0.33) increasing significantly from T1 [(mean of 7.1 (s.e.=0.31)( $F_{(1,36)}=19.19, p<0.001$ )] . The increased perceived pain assessment knowledge was maintained at T3 (mean of 8.9, s.e.=0.23) and was not significantly different from T2 (Table 1).

**Table 1: Mean difference in perceived pain assessment knowledge, pain assessment tool knowledge and confidence in assessment tools across time**

	Mean difference (95% C.I.)			
	Results on comparisons			
	T1 vs T2	T1 vs T3	T2 vs T3	Overall
<b>Perceived knowledge</b>	-1.3 (-2.1 - -0.6)	-1.7 (-2.2 - -1.1 )	-0.3 (-1.1 - 0.4)	$F_{(2, 35)}=31.92,$
	$p<.001$	$p<.001$	NS	$p<.001$
<b>Confidence</b>	1.9 (0.5-3.4)	-1.4 (-1.9 - -1.0)	-3.4 (-4.8 - -1.9)	$F_{(2, 35)}=32.34,$
	$p=.012$	$p<.001$	$p<.001$	$p<.001$
<b>Assessment tool</b>	-3.6 (-5.0 - -2.2)	-3.6 (-5.0 - -2.2)	-0.0 (-0.7 - 0.7)	$F_{(2, 35)}=21.23,$
	$p<.001$	$p<.001$	NS	$p<.001$

Significant differences in the mean perceived pain assessment tool knowledge scores across time were also found ( $F_{(2, 35)}=21.23, p<0.001$ ), with mean T2 score of 6.7 (s.e.=0.52) being significantly higher than the T1 mean score of 3.1 (s.e.=0.42) ( $F_{(1,36)}=39.85, p<0.001$ ). This increased perceived pain assessment tool knowledge was maintained at T3 (mean of 6.7, s.e.=0.52) and was not significantly different from T2.

The mean pain assessment confidence scores also changed across time ( $F_{(2, 35)}=32.34$ ,  $p<0.001$ ), but followed a slightly different pattern to that observed with perceived pain assessment knowledge. Mean T1 score of 7.8 (s.e.=0.28) was significantly higher than that of T2 (mean=5.9, s.e.=0.58) ( $F_{(1,36)}=7.05$ ,  $p=0.012$ ), but significantly lower than that of T3 with a mean of 9.2 (s.e.=0.23) ( $F_{(1,36)}=42.47$ ,  $p<0.001$ ). There was also a significant difference of mean confidence scores between T2 and T3 ( $p<0.001$ ) (Figure 4).



**Figure 4: Mean scores (95% C.I.) of the perceived pain assessment knowledge, pain assessment tool knowledge and confidence domains across time**

### Chart audit

There was no statistical difference in the profile of the patients included in the chart audits across the three data collection time points: age ( $F_{(2, 359)}=0.71$ ,  $p=0.0$ ), gender ( $\chi^2_2 = 4.53$ ,  $p=0.104$ ), length of stay (KW- test  $\chi^2_2 = 1.87$ ,  $p=0.392$ ), cancer types ( $\chi^2_2$

$\chi^2_4 = 7.14, p=0.129$ ) or reasons for admission ( $\chi^2_4 = 7.14, p=0.129$ ). The median length of stay was 7 days and was identical at all study time points, while the median age ranged from 51-56 years. Men made up between 40-53% of the patients whose charts were audited. Across the three time points, lung cancer was the most common diagnosis (11-19%) with half of all patients having been admitted for symptom control (47-52%), other than pain (Table 2).

The intervention resulted in a significant increasing linear trend in the proportions of documented pain score ( $\chi^2_{\text{trend}} = 23.17, df=1, p<0.001$ ) and documented pain assessments in patients chart from T1, T2 which continued after the feedback session at T4 ( $\chi^2_{\text{trend}} = 18.28, df=1, p<0.001$ ). There was also an increase in the median quality of the pain assessment documentation scores across time [T1, T2 and T4 (Kruskal-Wallis test  $\chi^2_1 = 7.17, p=0.007$ )] (Table 2).

**Table 2: Demographic profile of consecutive chart audit patients and pain assessment chart audit results over time**

	<b>T1</b>	<b>T2</b>	<b>T3*</b>	<b>T4</b>	
<b>Patient demographics</b>					
	N=127 (%)	N=130 (%)		N=105 (%)	
<b>Age (median)</b>	66 years	64.5 years		56 years	
<b>Male</b>	51 (40)	55 (42)		56 (53)	
<b>Length of stay (median)</b>	7 days	7 days		7 days	
<b>Cancer</b>					
Lung	20 (16)	24 (19)		11 (11)	
Breast	13 (10)	18 (14)		7 (7)	
Gynaecological	20 (16)	18 (14)		12 (12)	
Colorectal	10 (8)	6 (5)		8 (8)	
Other	94 (74)	88 (68)		97 (83)	
<b>Admission reason</b>					
Diagnosis/staging	4 (3)	6 (5)		2 (2)	
Treatment	9 (7)	9 (7)		8 (8)	
Surgery	11 (9)	17 (13)		15 (14)	
Pain management	41 (32)	27 (21)		22 (21)	
Symptom control	60 (47)	68 (52)		55 (52)	
Other	26 (21)	35 (27)		28 (27)	
<b>Pain assessment chart audit changes</b>	<b>T1</b>	<b>T2</b>	<b>T3*</b>	<b>T4</b>	<b>p</b>
	N=127 (%)	N=130 (%)		N=105 (%)	
Documented NRS pain	41 (32)	66 (51)		67 (64)	<i>p</i> <.001
Pain assessment chart usage	4 (3)	20 (15)		23 (22)	<i>p</i> <.001
Quality of pain assessment documentation (median score)	0.0	1.0		1.0	<i>p</i> <.007



## **Discussion**

This complex intervention increased nurses' pain assessment knowledge and pain assessment tool knowledge which was maintained out to 10 weeks. Despite previous studies having established an association between educational exposure to pain management principles and an immediate improvement in knowledge, few have demonstrated improvements in pain assessment practices that are sustained over time (Sherman, Matzo, Paice, McLaughlin, & Virani, 2004). The clinical practice improvements observed in our study are modest and confirm that there is still scope to increase the frequency with which nurses' routinely assess and documents their patients' cancer pain. Since this study was completed new cancer pain assessment learning modules have been developed by other organizations, which highlights the importance of focusing on cancer pain assessment as a distinct learning need (National Comprehensive Cancer Network, 2016).

The observation that the cancer nurses in this study were more confident about the requirements for undertaking a comprehensive pain assessment at the start of the study than they were after the intervention is reflective of a common phenomenon known as the 'illusion of explanatory depth' (Rozenblit & Keil, 2002). In accordance with this phenomenon, adults often overestimate the detail and depth of their explanatory knowledge, particularly for frequently encountered complex concepts (Eva, Cunningham, Reiter, Keane, & Norman, 2004). Completing a pain assessment fits in with this phenomena, because on the surface it is something that cancer nurses routinely undertake. However, completing a pain assessment is more complex than what it may first seem. It requires investigating not only the severity of the pain, but also what provokes the pain, its location(s), quality of the pain, its intensity, whether it radiates, the frequency and duration of the pain. An illusion of explanatory-depth

occurs when we believe we have a deeper understanding of an explanatory knowledge concept than we actually do (Alter, Oppenheimer, & Zemla, 2010; Rozenblit & Keil, 2002). As self-assessments are often poorly correlated with actual performance measures it is not until our confidence is tested that we realize that our knowledge is more superficial than we may have initially thought, which prompts us to address this gap (Eva et al., 2004). Identifying gaps in nurses' explanatory knowledge is highly relevant to the delivery of best evidence based practice and life-long learning.

It is very plausible that the 'illusion of explanatory-depth' was operating within our sample of cancer nurses, which explains the initial fall in confidence levels. As all of the nurses were managing pain on a daily basis it is understandable that they felt more confident at the commencement of the intervention, but this confidence was called into question as they worked their way through the online learning module and their pain assessment capabilities were tested. When confronted with the realization that they knew less than they originally thought, these cancer nurses could respond by continuing to engage with the learning content to strengthen their knowledge or withdraw from participating further, for fear of failing. Whilst it cannot be proven, the 'illusion of explanatory-depth' may have also impacted on completion rates. Better understanding the impact of this phenomenon on completion and non-completion rates may assist in designing more effective behavioral change interventions.

For the nurses' who completed the intervention, the testing and repeating of content as part of the online format is likely to have refreshed their pain assessment knowledge. Leading them to reflect on their usual pain assessment practices and contemplate the changes required to align their practice to guidelines recommendations. This may explain why, at the conclusion of the intervention (T2),

nurses felt less confident about their pain assessment capabilities, with self-confidence increasing significantly as they translated their newly acquired pain assessment knowledge into their usual clinical practice at T3. The fluctuation in pain assessment self-confidence observed in this study also reflects Bandura's Social Learning Theory (Bandura, 1977), whereby performance accomplishment increases self-confidence to repeatedly perform the skill and mirrors perceived ability to accomplish a task.

Similar to our previous reported pilot study results (Phillips et al., 2014), the intervention also improved the number and quality of pain assessments completed by participating nurses. The integration of pain assessment audit and feedback data into the intervention, in accordance with the Cochrane Review recommendations (Ivers et al., 2012), appears to have helped maintain the improvement in pain assessment documentation noted in the chart audits. While its attribution to the improvement noted cannot be confirmed, previous research has demonstrated that the benchmarked performance data which allows units to compare their performance is powerful and frequently helps create a pride-in-performance culture which can be used to leverage further gains through site based quality improvement initiatives (Powell et al., 2014). However, for lower performing units this type of performance feedback can be demotivating and may have little impact on improving outcomes (Hysong, 2009). Despite the improvement noted in the number and quality of the pain assessment documentation, the real challenge is to ensure that more nurses more frequently assess, document and report on their patients' pain. This is important in terms of responding appropriately to reduce the burden of unrelieved pain experienced by the patient, but also as a means of monitoring the quality of pain management within a health service. What is evident in this study is that, although there is evidence of

improvement in pain assessment practices, the actually number of patients with documented pain assessments is less than ideal.

### **Limitations and strengths**

This research demonstrated improvements in nurses' self-perceived pain assessment capabilities and modest improvements in adherence with recommended cancer pain assessment practices. It also ratifies the feasibility and acceptability of the complex evidence-based education intervention across multiple sites and has enabled the research team to refine how real-time benchmarked pain assessment performance data could be integrated into the online learning modules in a timely manner. It also confirms the scalability of 'spaced learning', which can be readily rolled out across multiple organizations at relatively low cost, while still maintaining original efficacy, which helps ensure a sustainable intervention.

However, the lack of control group and our inability to control for confounders and participant bias is a major limitation of this pilot study. It is possible that the participants who completed the intervention differed from the non-participants in terms of their motivations and capabilities. The observed changes in nurses' pain assessment capabilities and cancer pain assessment practices may be due to the online education intervention alone, and/or awareness that the charts would be audited.

Despite the high attrition between the T1 survey and enrolment into the online pain assessment learning module, participant engagement once the module was commenced was high, with a 90% completion rate. As the case scenarios mimicked clinical decision making it may have been confronting and uncomfortable for experienced cancer nurses who incorrectly answered routine clinical scenarios to

remain in the study, however this cannot be confirmed. Regardless of the reason, these attrition rates are similar to what has been reported in other studies utilizing the Qstream format (Dolan, Yialamas, & McMahon, 2015; Gyorki et al., 2013; Jiwa et al., 2014; Mathes, Frieden, Cho, & Boscardin, 2014).

Further, our inability to recruit ambulatory care cancer nurses, despite our best efforts and those of senior clinical leaders, is also a limitation. Identifying strategies to engage this sector of the cancer workforce requires further investigation, especially as most cancer care now occurs in this setting, placing these nurses at the forefront of providing safe and effective cancer care. Relieving pain is dependent upon good inter-professional practice, yet few interventions have effectively engaged both doctors and nurses, with most focusing exclusively on addressing the behavior of one discipline or the other (Goldberg & Morrison, 2007). In order to impact positively on patients' pain outcomes there remains a need for inter-professional interventions targeting nurses and physicians' pain assessment and reassessment skills (Goldberg & Morrison, 2007).

The ideal primary outcome would have been to assess the impact of this complex evidence-based educational intervention on cancer patients' reported pain outcomes. However, as most Australian cancer services do not routinely collect patient reported numerical rated symptom scores we were unable to readily capture this data. In the future, the proliferation of novel health technological solutions and the increased emphasis placed on patient reported outcomes will make capturing symptoms scores easier to achieve. These technological developments will also help drive the provision of better individualized evidence based care (Zucca, Sanson-Fisher, Waller, & Carey, 2014).

## **Conclusions**

Developing complex interventions underpinned by evidence based theories offer the greatest potential for changing clinical practice. Integrating an online case based module that mimicked clinical decision making with audit and feedback has enhanced inpatient cancer nurses' pain screening and assessment capabilities and improved their adherence to evidence based cancer pain guidelines. While these are important changes, the interventions ultimate value will be if can effectively reduce cancer patients' reported numerical pain scores.

## **Implications for Nursing**

This study speaks to the importance of focusing on building cancer nurses' pain assessment capabilities as a distinct but interrelated element of overall cancer pain management. In the absence of targeted undergraduate and post-graduate education it is likely that cancer nurses will not have the pre-requisite performance attributes to undertake a comprehensive pain assessment that includes more than noting their patients pain severity and location. As frontline health professionals who see cancer patients on a routine basis, in the community, ambulatory care or acute care settings, nurses need the skills to routinely screen for symptoms, undertake a comprehensive pain assessment when indicated and to rapidly escalate these findings to ensure that the patient's pain is managed in an appropriate and timely way. Ensuring that all cancer nurses are routinely screening cancer patients for pain, and then comprehensively assessing those whose pain is >3 on a NRS, is crucial to reducing the burden of unrelieved cancer pain. Whilst this pilot study has demonstrated the potential of a novel on-line learning intervention, further research is required to demonstrate the effectiveness of this type of education in changing clinical practice.

## **Acknowledgements**

The research team would like to acknowledge the valuable contribution of the clinical champions at each site, nursing unit managers and the oncologists who supported this study being undertaken in their workplace: Anne Booms, Elizabeth Browne, Carina Falomir, Rachelle Frith, Fiona Gillanders, Emma Hayes, Sarah Hayes, Zane Healy, Lee Khaw, Kim King, Tina Kulevska, Gemma Leake, Dr Winston Liauw, Dr Matthew Links, Linda Magann, Francine McCarthy, Natalie Maier, Joanne Newbury, Niamh O'Sullivan, Gabrielle Prest, Kim Rigg, Louisa Robinson, Mary Ryan, Amelia Tangi, Sally Watts, Dr Ramya Venkateswaran and Dr Lucy Wyld.

## **Funding**

This project is a Translational Cancer Research Network's Cancer Challenge of the Year initiative, supported by Cancer Institute NSW's translational cancer research centre program grant.

## **Conflict of interest statement**

The Authors declare that there is no conflict of interest.

## **Author contributions**

**Conception and design:** Jane Phillips, Tim Shaw, Nicole Heneka and Lawrence Lam

**Financial support:** Translational Cancer Research Network and the Cancer Institute New South Wales Academic Chairs Program.

**Administrative support:** Nicole Heneka and Paula Mohacsi

## References

- Allard, P., Maunsell, E., Labbe, J., & Dorval, M. (2001). Educational interventions to improve cancer pain control: a systematic review. *Journal of Palliative Medicine*, 4(2), 191-203.
- Alter, A. L., Oppenheimer, D. M., & Zemplin, J. C. (2010). Missing the trees for the forest: a construal level account of the illusion of explanatory depth. *Journal of Personality and Social Psychology*, 99(3), 436-451.
- Australian Adult Cancer Pain Management Working Group. (2013). Cancer Pain Management in adults. Evidence-based Clinical Practice Guidelines adapted for use in Australia. Retrieved from [http://wiki.cancer.org.au/australia/Guidelines:Cancer\\_pain\\_management](http://wiki.cancer.org.au/australia/Guidelines:Cancer_pain_management)
- Australian Institute of Health and Welfare. (2015). Australian hospital peer groups. Health services series no. 66. Cat. no. HSE 170. Canberra: AIHW.
- Bandura, A. (1977). *Social Learning Theory*. Englewood Cliffs, N.J.: Prentice Hall.
- Berry, P. H., & Dahl, J. L. (2000). The new JCAHO pain standards: Implications for pain management nurses. *Pain Management Nursing: Official Journal of The American Society of Pain*, 1(1), 3-12.
- Carr, E. C. J., Brockbank, K., & Barrett, R. F. (2003). Improving pain management through interprofessional education: evaluation of a pilot project. *Learning in Health and Social Care*, 2(1), 6-17.
- Cummings, G. G., Armijo Olivo, S., Biondo, P. D., Stiles, C. R., Yurtseven, Ö., Fainsinger, R. L., & Hagen, N. A. (2011). Effectiveness of knowledge translation interventions to improve cancer pain management. *Journal of Pain and Symptom Management*, 41(5), 915-939.
- Davidoff, F., Dixon-Woods, M., Leviton, L., & Michie, S. (2015). Demystifying theory and its use in improvement. *BMJ Quality & Safety*, doi:10.1136/bmjqs-2014-003627.
- de Rond, M. E. J., de Wit, R., van Dam, F. S. A., & Muller, M. J. (2000). A pain monitoring program for nurses: effects on communication, assessment and documentation of patients' pain. *Journal of Pain and Symptom Management*, 20(6), 424-439.
- Dolan, B. M., Yialamas, M. A., & McMahan, G. T. (2015). A Randomized Educational Intervention Trial to Determine the Effect of Online Education on the Quality of Resident-Delivered Care. *J Grad Med Educ*, 7(3), 376-381.
- Dy, S. M., Asch, S. M., Naeim, A., Sanati, H., Walling, A., & Lorenz, K. A. (2008). Evidence-based standards for cancer pain management. *Journal of Clinical Oncology*, 26(23), 3879-3885.
- Eva, K., Cunningham, J. W., Reiter, H., Keane, D., & Norman, G. (2004). How Can I Know What I Don't Know? Poor Self Assessment in a Well-Defined Domain. *Advances in Health Sciences Education*, 9(3), 211-224.
- Fishman, S. M., Young, H. M., Lucas Arwood, E., Chou, R., Herr, K., Murinson, B. B., . . . Strassels, S. A. (2013). Core competencies for pain management: results of an interprofessional consensus summit. *Pain Med*, 14(7), 971-981.
- Foley, K. M. (2011). How well is cancer pain treated? *Palliative Medicine*, 25, 398-401.
- Franck, L. S., & Bruce, E. (2009). Putting pain assessment into practice: why is it so painful? *Pain Research and Management*, 14(1), 13-20.
- Ger, L. P., Chang, C. Y., Ho, S. T., Lee, M. C., Chiang, H. H., Chao, C. S., . . . Wang, S. C. (2004). Effects of a continuing education program on nurses' practices of cancer pain assessment and their acceptance of patients' pain reports. *Journal of Pain and Symptom Management*, 27(1), 61-71.



- Goldberg, G. R., & Morrison, R. S. (2007). Pain management in hospitalized cancer patients: a systematic review. *Journal of Clinical Oncology*, 25(13), 1792-1801.
- Gordon, D. B., Dahl, J. L., Miaskowski, C., McCarberg, B., Todd, K. H., Paice, J. A., . . . Carr, D. B. (2005). American Pain Society recommendations for improving the quality of acute and cancer pain management: American Pain Society Quality of Care Task Force. *Arch Intern Med*, 165(14), 1574-1580.
- Gyorki, D. E., Shaw, T., Nicholson, J., Baker, C., Pitcher, M., Skandarajah, A., . . . Mann, G. B. (2013). Improving the impact of didactic resident training with online spaced education. *ANZ J Surg*, 83(6), 477-480.
- Herr, K., Titler, M., Fine, P., Sanders, S., Cavanaugh, J., Swegle, J., . . . Tang, X. (2010). Assessing and treating pain in hospices: current state of evidence-based practices. *Journal of Pain and Symptom Management*, 39(5), 803-819.
- Holen, J. C., Hjermstad, M. J., Loge, J. H., Fayers, P. M., Caraceni, A., De Conno, F., . . . Kaasa, S. (2006). Pain assessment tools: is the content appropriate for use in palliative care? *Journal of Pain and Symptom Management*, 32(6), 567-580.
- Hysong, S. (2009). Meta-analysis: audit and feedback features impact effectiveness on care quality. *Medical Care*, 47, 356 - 363.
- Idell, C. S., Grant, M., & Kirk, C. (2007). Alignment of Pain Reassessment Practices and National Comprehensive Cancer Network Guidelines. *Oncology nursing forum*, 34(3), 661-671.
- Institute of Medicine. (2011). *Relieving pain in America: A blueprint for transforming prevention, care, education, and research*: National Academies Press.
- International Association for the Study of Pain. (2012). Interprofessional Pain Curriculum Outline. Retrieved from <http://www.iasp-pain.org/Education/CurriculumDetail.aspx?ItemNumber=2057>
- Ivers, N., Jamtvedt, G., Flottorp, S., Young, J., Odgaard-Jensen, J., French, S., . . . Oxman, A. (2012). Audit and feedback: effects on professional practice and healthcare outcomes. *Cochrane Database Systematic Reviews*, 6, CD000259.
- Jiwa, M., Halkett, G., Meng, X., Pillai, V., Berg, M., & Shaw, T. (2014). Supporting patients treated for prostate cancer: a video vignette study with an email-based educational program in general practice. *J Med Internet Res*, 16(2), e63.
- Kerfoot, B. P. (2008). Interactive spaced education versus web based modules for teaching urology to medical students: a randomized controlled trial. *The Journal Of Urology*, 179(6), 2351-2356.
- Kerfoot, B. P. (2010). Adaptive spaced education improves learning efficiency: a randomized controlled trial. *The Journal Of Urology*, 183(2), 678-681.
- Kerfoot, B. P., Armstrong, E. G., & O'Sullivan, P. N. (2008). Interactive spaced-education to teach the physical examination: a randomized controlled trial. *Journal Of General Internal Medicine*, 23(7), 973-978.
- Kerfoot, B. P., & Baker, H. (2012). An online spaced-education game for global continuing medical education: a randomized trial. *Annals Of Surgery*, 256(1), 33-38.
- Kerfoot, B. P., & Brotschi, E. (2009). Online spaced education to teach urology to medical students: a multi-institutional randomized trial. *American Journal Of Surgery*, 197(1), 89-95.
- Kerfoot, B. P., DeWolf, W. C., Masser, B. A., Church, P. A., & Federman, D. D. (2007). Spaced education improves the retention of clinical knowledge by medical students: a randomised controlled trial. *Medical Education*, 41(1), 23-31.
- Kerfoot, B. P., Fu, Y., Baker, H., Connelly, D., Ritchey, M. L., & Genega, E. M. (2010). Online spaced education generates transfer and improves long-term retention of

- diagnostic skills: a randomized controlled trial. *Journal of the American College of Surgeons*, 211(3), 331-337.e331.
- Kerfoot, B. P., Fu, Y., Baker, H., Connelly, D., Ritchey, M. L., & Genega, E. M. (2011). Online spaced education generates transfer and improves long-term retention of diagnostic skills: A randomized controlled trial. *Journal of urology*, 186(2), 638. <http://onlinelibrary.wiley.com/o/cochrane/clcentral/articles/444/CN-00894444/frame.html> doi:10.1016/j.juro.2011.04.034
- Kerfoot, B. P., Kearney, M. C., Connelly, D., & Ritchey, M. L. (2009). Interactive spaced education to assess and improve knowledge of clinical practice guidelines: a randomized controlled trial. *Annals Of Surgery*, 249(5), 744-749.
- Kerfoot, B. P., Lawler, E. V., Sokolovskaya, G., Gagnon, D., & Conlin, P. R. (2009). Interactive Spaced Education improves clinicians' screening for prostate cancer: A multi-institutional randomized controlled trial. 4 SUPPL. 1. Retrieved from <http://ovidsp.ovid.com/ovidweb.cgi?T=JS&PAGE=reference&D=emed9&NEWS=N&AN=70112634>
- Kerfoot, B. P., Lawler, E. V., Sokolovskaya, G., Gagnon, D., & Conlin, P. R. (2010). Durable improvements in prostate cancer screening from online spaced education a randomized controlled trial. *American Journal of Preventive Medicine*, 39(5), 472-478.
- Kerfoot, B. P., Turchin, A., Breydo, E., Gagnon, D., & Conlin, P. R. (2014). An online spaced-education game among clinicians improves their patients' time to blood pressure control: a randomized controlled trial. *Circulation. Cardiovascular Quality And Outcomes*, 7(3), 468-474.
- Kerns, R. D., Otis, J., Rosenberg, R., & Reid, M. C. (2003). Veterans' reports of pain and associations with ratings of health, health-risk behaviors, affective distress, and use of the healthcare system. *Journal of Rehabilitation Research and Development*, 40(5), 371-379.
- Luckett, T., Davidson, P. M., Boyle, F., Liauw, W., Agar, M., Green, A., & Lovell, M. (2014). Australian survey of current practice and guideline use in adult cancer pain assessment and management: perspectives of oncologists. *Asia-Pacific Journal of Clinical Oncology*, 10(2), e99-107.
- Mathes, E. F., Frieden, I. J., Cho, C. S., & Boscardin, C. K. (2014). Randomized controlled trial of spaced education for pediatric residency education. *J Grad Med Educ*, 6(2), 270-274.
- McDonald, M. V., Pezzin, L. E., Feldman, P. H., Murtaugh, C. M., & Peng, T. R. (2005). Can just-in-time, evidence-based "reminders" improve pain management among home health care nurses and their patients? *Journal of Pain and Symptom Management*, 29(5), 474-488.
- Medical Research Council Health Services and Public Health Research Board. (2000). A framework for development and evaluation of RCTs for complex interventions to improve health.
- Miaskowski, C. (2010). Outcome Measures to Evaluate the Effectiveness of Pain Management in Older Adults With Cancer. *Oncology nursing forum*, 37, 27-32.
- Michie, S., van Stralen, M., & West, R. (2011). The behaviour change wheel: A new method for characterising and designing behaviour change interventions. *Implementation Science*, 6(1), 42.
- National Comprehensive Cancer Network. (2016). Clinical Practice Guideline in Oncology: Adult Cancer Pain. Retrieved from [https://www.nccn.org/professionals/physician\\_gls/f\\_guidelines.asp#pain](https://www.nccn.org/professionals/physician_gls/f_guidelines.asp#pain)

- Palliative Care Outcomes Collaboration. (2012). *Patient and Carer Experiences: Survey Results 2011*. Retrieved from
- Phillips, J. L., Heneka, N., Hickman, L., Lam, L., & Shaw, T. (2014). Impact of a novel online learning module on specialist palliative care nurses' pain assessment competencies and patients' reports of pain: Results from a quasi-experimental pilot study. *Palliat Med*, 28(6), 521-529.
- Phillips, J. L., & Piza, M. (2010). *Level and quality of end-of-life care at Sacred Heart Hospice in 2010: a snap-shot audit report* The Cunningham Centre for Palliative Care, Sydney.
- Pidgeon, T., Johnson, C. E., Currow, D., Yates, P., Banfield, M., Lester, L., . . . Eagar, K. (2015). A survey of patients' experience of pain and other symptoms while receiving care from palliative care services. *BMJ Supportive & Palliative Care*.
- Powell, A. A., White, K. M., Partin, M. R., Halek, K., Hysong, S. J., Zarling, E., . . . Bloomfield, H. E. (2014). More than a score: a qualitative study of ancillary benefits of performance measurement. *BMJ Quality & Safety*.
- Rozenblit, L., & Keil, F. (2002). The misunderstood limits of folk science: An illusion of explanatory depth. *Cognitive Science*, 26(5), 521-562.
- Shaw, T., Long, A., Chopra, S., & Kerfoot, B. P. (2011). Impact on clinical behavior of face-to-face continuing medical education blended with online spaced education: a randomized controlled trial. *The Journal Of Continuing Education In The Health Professions*, 31(2), 103-108.
- Shaw, T. J., Pernar, L. I., Peyre, S. E., Helfrick, J. F., Vogelgesang, K. R., Graydon-Baker, E., . . . Gandhi, T. (2012). Impact of online education on intern behaviour around joint commission national patient safety goals: a randomised trial. *BMJ Quality & Safety*, 21(10), 819-825.
- Sherman, D. W., Matzo, M. L., Paice, J. A., McLaughlin, M., & Virani, R. (2004). Learning pain assessment and management: a goal of the End-of-Life Nursing Education Consortium. *Journal of Continuing Education in Nursing*, 35(3), 107-120.
- van den Beuken-van Everdingen, M. H. J., de Rijke, J. M., Kessels, A. G., Schouten, H. C., van Kleef, M., & Patijn, J. (2007). Prevalence of pain in patients with cancer: a systematic review of the past 40 years. *Annals of Oncology*, 18(9), 1437-1449.
- von Elm, E., Altman, D. G., Egger, M., Pocock, S. J., Gotsche, P. C., Vandenbroucke, J. P., & Initiative, S. (2007). The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *Annals of Internal Medicine*, 147(8), 573-577.
- Zucca, A., Sanson-Fisher, R., Waller, A., & Carey, M. (2014). Patient-centred care: making cancer treatment centres accountable. *Supportive Care in Cancer*, 22(7), 1989-1997.