Title: Impact of a novel online pain assessment learning pain module on palliative care nurses' pain assessment competencies and patients' reports of pain: results from a quasi-experimental pilot study

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ABSTRACT

Background

Pain is a complex multidimensional phenomenon moderated by consumer, provider and health system factors. Effective pain management cuts across professional boundaries, with failure to screen and assess contributing to the burden of unrelieved pain.

Aim

To test the impact of an online pain assessment learning module on specialist palliative care nurses' pain assessment competencies, and to determine if this education impacted positively on palliative care patients' reported pain ratings.

Design

A quasi-experimental pain assessment education pilot study utilising 'Qstream'© an on-line methodology to deliver 11 case-based pain assessment learning scenarios, developed by an interdisciplinary expert panel and delivered to participants' work emails over a 28 day period in mid-2012. The 'Pain Assessment Competencies' survey and chart audit data, including patient reported pain intensity ratings, were collected pre (T1) and post (T2) intervention and analysed using inferential statistics to determine key outcomes.

Setting/participants: Specialist palliative care nurses working at Australian specialist palliative care services in 2012.

Results

The results reported conform to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement. Participants who completed the education intervention (n=34) increased their pain assessment knowledge, assessment tool knowledge and confidence to undertake a pain assessment (p<0.001). Participants were more likely to document pain intensity scores in patients' medical records than non-participants (95% C.I.=7.3% - 22.7%, p=0.021). There was also a significant reduction in the mean patient reported pain ratings between the admission and audit date at post-test of 1.5 (95% C.I.=0.7-2.3) units in pain score.

Conclusion

This pilot confers confidence of the education interventions capacity to improve specialist palliative care nurses' pain assessment practices and reduce patient rated pain intensity scores.

KEY WORDS: Palliative care, nurses, pain assessment, learning, professional education, intervention, translational medical research.

What is already known about the topic?

- Pain is a complex multidimensional phenomenon moderated by consumer, provider and health system factors.

- Effective pain management in specialist palliative care cuts across professional boundaries, with failure to screen and assess contributing to the burden of unrelieved pain.

- Few educational interventions have targeted pain assessment as a distinct and separate learning component, with most embedding assessment into the overall pain management learning intervention.

What this paper adds?

- This quasi-experimental design pilot study demonstrates that a novel on-line learning intervention incorporating the principles of 'spacing' and 'testing' learning content can positively impact on knowledge, confidence, pain assessment practices and patient reported pain outcomes.

Implications for practice, theory or policy?

- Adopting evidence based learning theories for the development of tailored clinical education programs offers the potential of addressing evidence-practice gaps and impacting positively on patient reported outcomes.

Background

A range of consumer, provider and health system factors impact on patients' pain experiences, with inadequate screening and assessment identified as one factor contributing to unrelieved pain.[1, 2] Even within specialist cancer and palliative care settings where pain is almost always universally experienced by patients, there is often poor compliance with routine pain screening and assessment practices, with patient reported pain intensity ratings frequently not documented.[3, 4] Instead of seeking a patient reported numerical pain rating, most clinicians adopt informal screening approaches such as "are you hurting?" used in 50% of clinical encounters.[5] In the United States pain is now recognised as the fifth vital sign, with patients' rights to being pain free embedded in hospital accreditation standards.[6] These standards demand that clinicians systematically screen for pain, with a positive screen prompting a pain intensity score and an pain assessment,[7] noting location, temporal pattern(s), and identification of treatment and exacerbating and/or relieving factors.[8] At a minimum, cancer and palliative care clinicians are expected to routinely screen for pain and document pain intensity.[9] Evidence of these screening and assessment practices are increasingly being recommended as quality indicators of optimal cancer pain management.[7, 10]

In Australia, services participating in the Palliative Care Outcomes Collaborative (PCOC) routinely capture patient reported pain intensity scores on a daily basis for inpatients and at each visit for community patients.[11] Despite this imperative, a study conducted within one large Australian specialist palliative care service found little documented evidence of either routine pain screening or a comprehensive pain

assessment having been undertaken if pain was identified.[12] A survey found that 35% of respondents, cared for by 13 different Australian specialist palliative care services, reported having moderate pain which restricted their activity in the three days prior to completing the patient experiences survey.[13] These gaps suggest that even within specialist palliative services there are opportunities to strengthen pain outcomes by focusing on routine pain screening and assessment practices.

Changing behaviour in dynamic clinical environments is challenging, and requires a systematic and critical analysis of priorities and presumed causes. A range of predisposing, enabling and reinforcing factors are known to shape clinicians' pain assessment practices, including: their assessment knowledge, skills and practices (competencies)[14]; understanding of suitable assessment tools; commitment and capacity to integrate pain assessment findings into clinical decision making[15]; communication skills; and capacity to address their patients' care needs within the context of multi-professional practice.[16]

While numerous education interventions have been developed to address these gaps in the cancer or specialist palliative care settings[17], few have targeted pain assessment as a distinct and separate learning component, with most embedding assessment into the overall pain management intervention.[3] A recent Taiwanese hospital-based pre-post-test study using multiple learning methods, including four lectures, a one day workshop and printed material, increased nurses' cancer pain assessment capabilities and acceptance of patients' reports of pain.[18] A randomised control trial (RCT) compared a low intensity education intervention, where community nurses on referral of a patient with cancer received an email highlighting six cancer pain-specific clinical pain

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assessment and management recommendations (control), to a higher intensity educational intervention where the email sent to the nurse was augmented with provider prompts, patient education material, and clinical nurse specialist outreach support (intervention).[19] Despite having limited effect on nurse documented pain assessment practices, patient pain outcomes were positively influenced in both groups suggesting that email reminders appear to have a role in improving cancer pain management, while a more intensive approach is required to improve nurses' pain documentation practices.[19] A meta-analysis of cancer pain management knowledge translation interventions targeting the uptake of new evidence found that more intense interventions involving extensive follow-up, a comprehensive educational program, and higher resource allocation were significantly more likely to impact positively on reducing cancer pain.[20]

'Qstream'© – a novel on-line learning platform

Technological advances have facilitated the evolution of various online learning platforms, pod-casting, and web-based video conferencing.[21] Whilst online learning extends the educational reach to a wider audience, the challenge is to make the delivery format as participatory and active as possible. One possibility is 'Qstream'© (previously called 'Spaced Education'), which is a real-time commercially available learning analytics platform that promotes active learning.[22] This on-line platform takes advantage of the psychological finding that education encounters which are 'spaced' and 'repeated over time' result in more efficient learning and improved retention compared to a bolus distribution learning format.[23] It 'pushes' clinical questions or case based scenarios to the participant's email which take less than five minutes to answer

and provides immediate feedback upon submitting a response. When delivered prospectively, it can generate significant topic specific learning.[24] In several RCTs, 'Qstream'© has been shown to improve knowledge acquisition, boost knowledge retention from three months and out to 2 years, and impacts positively on entrenched clinical practice and outcomes.[25-27] The ultimate learning initiative is one that makes a demonstrable difference to care outcomes. Yet, the primary endpoints for most cancer and/or palliative care pain educational interventions have measured process outcomes such as increasing clinicians' knowledge, attitudes, skills, and behaviours with very few measuring clinical outcomes, even as a secondary outcome measure.[28, 29]

Aim

To test the impact of an on-line pain assessment learning module on specialist palliative care nurses' pain assessment competencies, and to determine if this educational intervention impacted positively on palliative care patients' reported pain ratings.

Design

Setting/participants

This pre-post-test pilot study was undertaken during 2012. All of the 103 registered and enrolled nurses (nurses) employed for more than 16 hours per week at two specialist palliative care services, in Sydney, Australia were invited to participate.

Ethics

Written informed consent was obtained from all participants in accordance with the ethical approval secured from the relevant health service and university human ethics

research committees [Ethics approval: 11/077 and 1012.04.03]. The study complied
with the Declaration of Helsinki ethical rules.

Pain assessment education intervention

Eleven case-based pain assessment scenarios were developed by an interdisciplinary
panel of palliative care and educational experts, using a systematic process. Each case
considered pain assessment within the context of: best evidence based practice, patient
preferences; their unit of care; inter-professional practice; and the nurse as patient
advocate.[30] Participants received the cases via email as multi-choice questions or as
short answers in an 'open 140' (Tweet) format over a 28 day period. The correct
answer was provided as soon as a response was submitted, providing participants with
their peers' de-identified answers, a key take home message and links to evidence-based
practice resources. Cases were retired once correctly answered on two consecutive
occasions.

The support of institutional leaders helped optimise nurses' participation in the study
by: suspending other mandatory learning initiatives; allocating participants 20 minutes
per week to complete the online learning content at work; and by increasing the number
of designated computer workstations.

Variables

It was hypothesised that completion of the on-line pain assessment module would: i)
increase the number of documented pain assessments by intervention participants; and
ii) reduce intensity of patients' reported pain numerical rating scores.

Data Sources

Survey: The Self-Perceived 'Pain Assessment Competencies' survey (Self-PAC Survey) was developed by an interdisciplinary expert panel following an exhaustive search to identify a suitable validated instrument that focused on clinicians' pain assessment competencies. The 17 survey questions reflected the essential elements of a comprehensive pain assessment identified in the literature.[31] The Self-PAC Survey was tested with a small sample of specialist palliative care nurses (n=6) prior to being administered in the clinical setting.

The Self-PAC Survey sought demographic information related to clinical experience, post-graduate education, and insights into pain assessment capabilities through a series of pain assessment knowledge and confidence questions. An 11 point visual analogue rating scale ranging from 'no knowledge/not confident' (0) through to 'extensive knowledge and extremely confident' (10) was used to score the pain assessment knowledge and confidence questions. The Self-PAC Survey has three distinct sub-scales, with Cronbach alpha reporting acceptable internal consistency reliability: seven item pain assessment knowledge (0.944); three item pain assessment tool knowledge (0.846); and seven item pain assessment confidence (0.919) scales.

Chart audit data: Prospective chart audits of 60 consecutive palliative care patients admitted with pain and/or who subsequently developed pain during the audit period. A standardised pain assessment audit tool, designed to capture pain assessment practices at admission, and throughout the admission and up to the *a priori* audit date for patients who hadn't been discharged, was utilised. Charts 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. Each potentially eligible medical record, including the medication chart, pain assessment form and clinical entries, was reviewed to determine if the patient met the inclusion criteria. As each patient was cared for by multiple nurses the date, time, names and positions of all clinicians making pain assessment notations in the patient's medical records were captured. The Time 1 (T1) data was collected one month immediately prior to the intervention commencing in mid-2012 and Time 2 (T2) was collected six weeks after the intervention finished. All chart audit abstractions were undertaken by a trained research assistant (NH).

Bias and study size

The small potential sample size prevented a larger controlled study being undertaken during this pilot phase. The chart audit period inclusion dates were blinded to all participants and managers.

Data analysis

Quantitative variables: Statistical analyses were performed using SPSS software V20. Descriptive analyses were applied to all variables of interest and the outcomes. For ease of analysis, groups of small sizes were combined to form a larger group resulting in all demographic variables with two sub-groups. Independent sample t-test was used to compare the 'responders' (participants who completed the T1 and T2 surveys and the intervention) and 'non-responders' (participants who only completed the T1 survey). A paired sample t-test was used to determine if there was a difference between nurses' pain assessment: knowledge, tool awareness and confidence scores at T1 and T2.

The difference in number of documented pain ratings in the medical records by intervention participants between T1 and T2 was calculated and the association between intervention participation and assessments at the two time points was examined using Pearson chi-square test. Differences in daily patient reported pain rating between admission and the *a priori* audit date were examined using paired t-test. A significance level of 5% was used for all hypothesis testing. The 95% Confidence Intervals (95%C.I.) of the differences were also calculated.

RESULTS

Survey results: The study conduct and participant flow is outlined in Figure 1. Sixty per cent (n=45) of the participants who enrolled in the study (n=74) subsequently completed the baseline survey (T1) and went on to complete the online pain assessment learning module ('intervention'). Of those that completed the intervention, 75% (n=34) proceeded to complete the T2 survey.
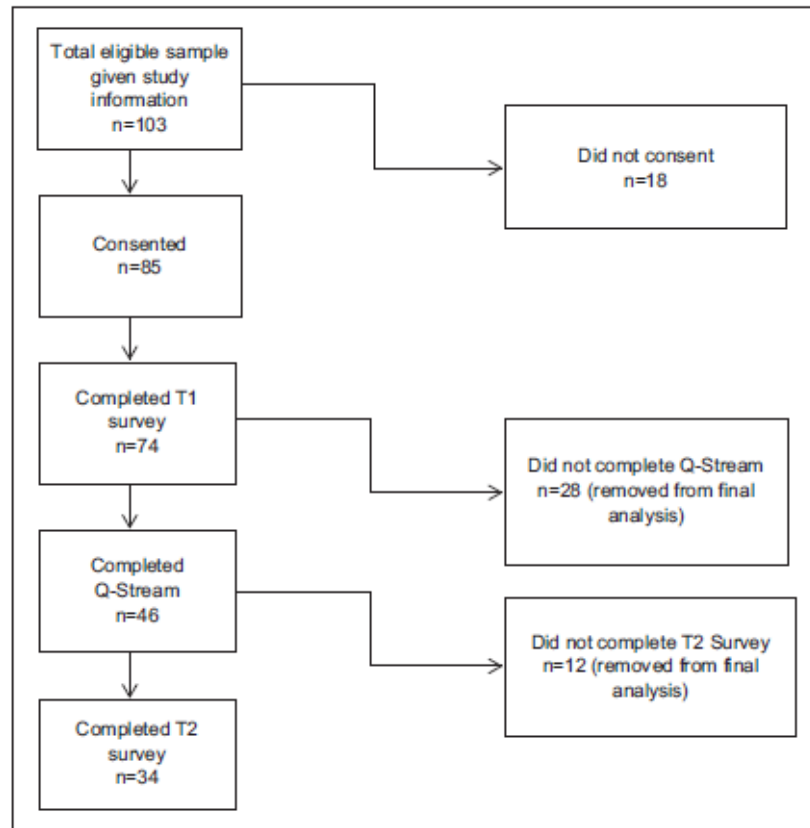
Figure 1. STROBE study conduct and participant flow.
STROBE: Strengthening the Reporting of Observational Studies in Epidemiology.

Descriptive data: The majority of participants who completed the intervention were female (94%), registered nurses (88%), with a median age of 43 (Table 1). An association between length of employment at the site and completion of the online learning module and the T2 survey was found, x^2 =4.671, p=0.03, with participants employed for less than five years being more likely to have completed the intervention. There was no association between age, discipline, frequency of pain management or education between intervention participants and non-participants.

Table 1. Participant demographics and palliative care experience, Time 1–2.

		Time 1 n (74)	%	Time 2 n (34)	%	p
Gender	Female	71	96	32	94	–
	Male	3	4	2	6	–
Age (years)	Mean (SD)	45.3	SD ± 11.1	43.5	SD ± 11.5	NS
	Median	45.7			43	–
Discipline	Registered nurse	62	84	30	88	NS
	Enrolled nurse	12	16	4	12	–
Specialist palliative care setting	Inpatient unit	60	81	28	82	–
	Community	14	19	6	18	–
Years caring for palliative care patients	≤10 years	41	55	22	65	NS
	≥11 years	33	45	12	35	–
Years working at site	≤5 years	42	57	23	68	0.03
	≥6 years	28	40	8	24	–
Frequency of palliative patients' pain management	≤Once per day	33	45	13	38	–
	≥Several times per day	40	54	21	62	–
Specialist palliative care nursing short course	Completed	28	38	12	35	NS
	Undertaking	6	8	2	6	NS
Specialist palliative care nursing postgraduate award	Completed	23	31	13	38	–
	Undertaking	4	6	3	9	–

SD: standard deviation.

A significant difference was found between participants' mean pain assessment competencies scores, with improvements across all three pain assessment domains when comparing T1 to T2 scores: pain assessment knowledge (-1.2, 95% C.I. = - 1.7 - -0.7), pain assessment tool awareness (-3.1, 95% C.I.= -5.2 - -0.9), and pain assessment confidence (-1.9, 95% C.I.= -3.2 - -0.6).

Table 2. Pain assessment competencies (rating scale 0–10).

Pain assessment domains	Time 1 (n = 34) Mean (±SD)	Time 2 (n = 34) Mean (±SD)	p	Differences between Time 1 and Time 2 CI (95%)
Knowledge	7.1 (1.7)	8.38 (1.0)	0.001	(−1.2, −1.7 to −0.7)
Tool awareness	3.14 (2.09)	6.30 (5.8)	0.007	(−3.1, −5.2 to −0.9)
Confidence	7.40 (1.63)	9.30 (3.5)	0.007	(−1.9, −3.2 to −0.6)

SD: standard deviation; CI: confidence interval.

Chart audit

The demographics reported for the T1 and T2 patient cohort who experienced pain during the audit period is summarised in Table 3. There is very little difference between the two cohorts, with the main difference relating to gender, with more male charts audited during T2 compared to T1 (57% vs. 38%).

Table 3. Chart audit demographics, Time 1–2.

		T1		T2	
		N = 60	%	N = 60	%
Gender, n (%)	Male	23	38.3	34	56.7
	Female	37	61.7	26	43.3
Age	Median (years)	74		74.5	
	SD	72.6	11.7	72.9	12.6
Primary diagnosis	Cancer	53	88.3	· 54	90.0
	CHF	1	1.7	1	1.7
	COPD	1	1.7	1	1.7
	Neurological	2	3.3	0	0
	Renal	2	3.3	0	0
	Other	1	1.7	4	6.6
Reason for admission	Pain control	23	38.3	20	33.3
	Symptom control (other than pain)	19	31.7	27	45.0
	Respite	1	1.7	1	1.7
	Terminal care	14	23.3	7	11.7
	Supportive care	2	3.3	3	5.0
	Other	1	1.7	2	3.3
Total length of stay this admission (days)	Median (days)	20 days		25 days	
Mean pain score	Mean (±SD)	3.9 (2.9)		2.4 (2.8)	

SD: standard deviation; CHF: chronic heart failure; COPD: chronic obstructive pulmonary disease.

There was a significant reduction in the mean patient reported pain ratings between the admission and audit date at T2 ($\bar{x}$=2.4) compared to T1 ($\bar{x}$=3.9) (t=1.51, df= 82, p<.0.001). Representing a reduction of 1.5 (95% C.I.=0.7-2.3) units in pain score in T2 in comparison to T1 (Table 3). There was a significant difference between pain intensity documentation by intervention participants from T1 and T2 (54% vs. 69%) (x^2, 2 =5.31, df=1, p=0.021; 15%, 95% C.I.=7.3% - 22.7%). However, there was no

significant difference in the documentation from T1 and T2 (n=12) of other pain

descriptors in individual patient's medical records (26% vs. 40%).

DISCUSSION

The learning intervention increased specialist palliative care nurses' competencies

across the three domains of pain assessment: knowledge, tool awareness and

confidence. It also increased the frequency of patients' documented pain intensity

ratings. During the study period there was also a decrease in patient reported pain

intensity ratings. However, there are several limitations that need to be taken into

consideration when considering these pilot study results, namely the small sample size,

lack of randomisation and absence of a control group. Despite the study having high

level organisational support and key stakeholder input into shaping the intervention, the

attrition rate was higher than the 20% loss to follow-up anticipated *a priori*. This is less

than the completion rates reported by previous studies utilising the same on-line

learning platform, although these studies have mostly been directed at doctors.[23, 27]

Despite previous studies having established an association between educational

exposure to pain management principles and improved knowledge, few have

demonstrated an improvement in pain assessment practices.[30] Even fewer clinical

educational interventions have demonstrated the capacity to impact positively on patient

reported pain outcomes. While this study's statistical reduction in mean patient

reported pain scores post-intervention is not considered clinically significant[32], a 1.5

point mean reduction in pain intensity ratings as a result of a pilot educational

intervention is encouraging. Given pain's multi-dimensional nature, any intervention

that can incrementally improve patient reported pain outcomes is a welcome addition to currently available treatments.

This on-line pain assessment module provided a different way of delivering learning content to nurses who spend a considerable part of the day managing patients' pain, and for whom pain assessment is integral to the care they provide. Focusing exclusively on pain assessment increased the intervention 'dose' as the learning content was not diluted to integrate numerous pain management principles. Combining clinically authentic scenarios, which are known to impact on clinician knowledge and behaviour[33] with the psychological principles of 'repeating' and 'testing' learning content underpins the power of this delivery methodology. These results are similar to those reported by other 'Qstream'© interventions, which have impacted positively on medical practitioners' knowledge retention and behaviour.[23, 27] However, the point of difference is that this study has identified a potential impact of the online learning content on patient reported outcomes, which has not been previously been reported.

Despite improvements in nurses' pain assessment knowledge, confidence and skills, the documentation of other pain dimensions considered essential to informing clinical decision making did not increase significantly as a result of the on-line learning intervention. Similar results have been noted in other educational studies with pain intensity and location more likely to be routinely documented post intervention than other pain dimensions.[9] While unidimensional instruments such as the visual analogue scale (VAS) or numerical rating scale (NRS) are helpful as screening tools and anchoring pain intensity, they do not capture the breadth of clinical information required to inform decision making, namely: the pain's location, temporal patterns or the

relieving or exacerbating factors, disease process and clinical context(s).[34] While this additional information better reflects the full dimensions of the patient's pain, systematically capturing these details requires nurses to be: familiar with the dimensions of a comprehensive pain assessment, prepared to repeat this process on multiple patients, on multiple occasions, and to consistently document their findings. As this is a repetitive and time consuming process, the routine use of a validated pain assessment tool offers the opportunity to capture these comprehensive pain dimensions in a more systematic and less laborious format through real-time point of care data collection methods. The full benefits of comprehensive pain assessment data may not be fully realised until there are computerised electronic records and a validated tool that accurately captures patient's dynamic pain states in real-time and allows clinicians to respond accordingly.[35]

Whilst age and level of education did not impact on participation rates in our study, nurses who had worked for less than five years in the palliative care setting were more likely to have completed the pain assessment module. One of the challenges when dealing with experienced clinicians is to harness the strengths experience provides, whilst providing education that re-engages and inspires them to consider new evidence and ways of working, especially if their practice is somewhat automated and routine.[36] Nurses who regularly attend pain in-service programs have been found to be both more knowledgeable and to have more positive attitudes towards pain management than their peers.[37] This makes identifying strategies to engage nurses who have worked in the specialist clinical setting for longer than five years in pain assessment education initiatives an important priority.

The strengths of this study relate to its feasibility, acceptability and encouraging pilot data related to the impact on clinicians pain assessment capabilities and patient reported pain outcomes. The scalability of this on-line format offers the opportunity to make learning content available to a wider audiences, regardless of geographical location. However, to fully exploit this opportunity, learners need to have both the hardware and information technology skills to fully engage with the content.[21]

Future research

These pilot study results will be used to power a future larger randomized control trial. However, investigating the degree to which responder burden, relevance of the learning content, delivery method and computer literacy contributed to attrition ought to be explored before proceeding to a larger study. Consideration also needs to be given to strengthening the intervention by blending on-line learning modules with other evidenced based behavioural change learning strategies.[38] Inclusion of an audit and feedback[39] element may strengthen the interventions ability to impact positively on patient's pain outcomes. Utilising Mitchie's Behavioural Change Wheel[39], based on a comprehensive systematic review, will assist by expanding the pain assessment learning content into a complex intervention[38] incorporating other evidence based behavioural change strategies. Linking evidence based pain guidelines into the educational intervention may further increase its potential to impact positively on patient's pain outcomes.

CONCLUSIONS

This study has demonstrated the online learning interventions capacity to increase nurses' pain assessment capabilities and impacting positively on patient reported pain outcomes. Given the central role nurse's play in pain assessment processes this is an important result. Especially as determining the best way of managing the patients' pain is dependent upon systematic and robust assessment, identification of the underlying pain mechanism, and integration of appropriate multi-modal approaches tailored to address each patient's pain requirements. An adequately powered larger pragmatic trial with a larger sample is required to confirm these results. There is potential for this on-line intervention to be integrated into larger multi-faceted translational research intervention targeting nurses' knowledge, attitudes and practices. Consideration ought to be given to adopting a blended learning approach, integrating evidence based behavioural change strategies so as to appeal to nurses who are challenged by online learning formats.

Conflict of interest statement

The Authors declare that there is no conflict of interest.

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