

# Use of TIME to improve community nurses' wound care knowledge and practice

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## Abstract

**Background:** The TIME framework was developed by the International Advisory Board for Wound Bed Preparation (WBP) (Schultz et al, 2003), as a practical tool for use in the clinical setting and summarises the four main components of WBP: tissue, infection/inflammation, moisture, edge. **Aims:** To examine the impact of delivering an educational programme using the concept of WBP and the associated TIME framework on community nurses' wound care knowledge and practice. **Methods:** An experimental pre-test–post-test design using repeat measures was used to test the hypothesis that a structured educational intervention based on the TIME framework would positively impact on community nurses' wound care knowledge and practice. Data was collected using questionnaires, non-participant observation and recording of data from patients' clinical records. **Results:** Community nurses' wound care knowledge and practice improved significantly after training ( $t[39]=17.37$ ,  $p<0.001$  and  $t[32]=7.12$ ,  $p<0.001$ , respectively). **Conclusions:** The TIME framework is a useful tool for delivering wound care education and can make significant improvements to wound care practice. **Conflict of interest:** None.

## KEY WORDS

TIME framework  
Education  
Wound care knowledge and practice  
Wound bed preparation (WBP)

Caring for people with wounds is costly, both financially and in terms of the impact on the patient's quality of life. The cost of wound care in the UK accounts for 3% of the annual National Health Service expenditure. This has been estimated at £2.3–£3.1 bn per year (Drew et al, 2007). This does not reflect litigation costs that result from complications or, indeed, the hidden costs to the patient, such as pain, depression and social isolation. The majority of these wounds are chronic in nature such as leg and pressure ulcers, and are cared for in the community setting by general practitioners and community nurses. Evidence from the literature shows that there are variations in wound care practice

(Harding, 2000), leading to inequalities in the care provided to patients. The wide variety and availability of wound management products can also lead to variations in practice. Huynh and Forget-Falcicchio (2005) in a retrospective analysis of patients' notes showed that there were wide variations in the number of dressings used and the frequency of dressing change, with no clear rationale for the variation. More interestingly, they also demonstrated that there was no correlation between the number of treatment procedures and the rate of healing. Wound management documentation is also variable (Tapp, 1990), and, although wound assessment and evaluation forms are often available, not all practitioners use them, as demonstrated in this study.

Wound assessment and management documentation is important for continuity of care, particularly in the community setting where many different clinicians visit the patient without supervision and rely on an up-to-date treatment plan. Poor documentation can lead to poor quality of care for patients. Appropriate selection of treatment based on the underlying cause and condition of the wound, as well as accurate documentation are indicators of quality of care (Ousey and Shorney, 2009). There is currently a drive to improve quality in the NHS and a systematic approach

to wound assessment and management can facilitate the delivery of high quality care for patients. The concept of Wound Bed Preparation (WBP) and the TIME framework was developed as a systematic approach to the management of chronic wounds, and has the potential to offer a solution in terms of addressing inequalities in care provision (Schultz, 2003).

Wound bed preparation has been defined as 'the management of a wound in order to accelerate endogenous healing or to facilitate the effectiveness of other therapeutic measures' (Falanga, 2000). The concept of WBP focuses the clinician on optimising conditions at the wound bed so as to encourage normal endogenous healing. It is an approach that should be considered for all wounds that are not progressing to normal wound healing (Dowsett and Ayello, 2004). WBP should be considered within the context of total patient care and should include a comprehensive assessment of the patient, treatment of the underlying condition and an appreciation of the patient's concerns and priorities (Sibbald et al, 2000). Four main components are proposed as the mainstay of treatment using WBP. These have been abbreviated using the acronym TIME and include:

- ▶ T tissue debridement to remove sloughy and necrotic tissue

- ▶ **I** control of bacteria and infection, prevention and management
- ▶ **M** maintenance of moisture balance
- ▶ **E** epidermal advancement (Schultz et al, 2003).

The TIME framework was developed by the International Advisory Board for WBP as a practical tool to assist with preparation of the wound bed for healing (Schultz et al, 2003). A body of literature describes the components of the TIME framework and case study examples of its practical implementation (Dowsett and Ayello, 2004; Moffatt et al, 2004; Dowsett and Newton, 2005). Watret (2005) describes the use of TIME as a theoretical framework to structure education which was well evaluated on delivery, but the impact on practice was not investigated. Shorney (2007) used a survey methodology to assess the perceived value of the TIME framework as an educational tool. The results showed an improvement in knowledge and a belief that this would impact on practice.

Evidence from the literature supports the theory that education does improve knowledge; however, it is more difficult to measure the impact of improved knowledge on practice (Allison, 1995; Jones and Nelson, 1997; Lloyd Jones et al, 2003; Wong, 2003). Luker and Kendrick (1995) used a validated questionnaire to measure knowledge and reported practice of community nurses concerned with the treatment of leg ulcers generally. The results were calculated in terms of the difference between the pre- and post-education intervention scores, and included scores on assessment, treatment and reported knowledge and practice. From the available score of 62, the pre-educational intervention mean score was reportedly 26 (42%). Knowledge and reported practice scores increased from 26 (42%) to 33 (53%) post-educational intervention. The result was found to be highly significant ( $t=10.54, p=0.000$ ).

Jones and Nelson (1997) reported on the impact of a leg ulcer educational intervention upon knowledge base and reported practice. They conducted a study involving 264 community nurses using a knowledge and reported practice questionnaire before and after an educational intervention. The results were

**Table 1**  
Overview of educational programme

Module 1	Module 2
Physiology of wound healing Acute and chronic wound healing	Tissue management Assessment, treatment, outcomes
Patient and wound assessment Treatment of underlying cause	Infection/inflammation control Assessment, treatment, outcomes
Wound Bed Preparation Definition and development	Moisture balance Assessment, treatment, outcomes
Overview of the TIME framework Links between elements of TIME	Edge evaluation Assessment, treatment, outcomes

calculated in terms of the difference in pre- and post-educational intervention scores. A significant increase in scores was reported for the experimental group from 25 to 34 (55%). Similar results were found in a Hong Kong study involving 42 community nurses that examined the effect of a teaching programme on community nurses' knowledge of leg ulcer management. Pre- and post-educational intervention knowledge scores were obtained by totalling responses to each of the four sections of a knowledge questionnaire. Knowledge scores were reported to increase from 10.3 (34%) to 20.4 (68%) following a three-hour educational intervention, where the total score availability was thirty (Wong, 2003). This study is unique in that it sought to examine both knowledge and practice in wound care in the real life setting, following delivery of wound care education that incorporated the TIME framework.

### Methods

The author's study utilised an experimental pre-test–post-test design using repeat measures. The study hypothesised that a structured educational intervention based on the concept of WBP and the TIME framework would positively impact on community nurses' knowledge and practice in wound care. The dependent variable was defined as the level of change in wound care knowledge and practice as demonstrated by community nurses. The independent variable was defined as the educational intervention, the presumed cause of changes in knowledge and practice. The dependent variable was measured by the use of questionnaires and non-participant

observation of clinical practice in wound care, before and after the introduction of an educational programme. The independent variable was operationalised by delivering an educational programme on the TIME framework to community nurses over a series of two, half-day modules. Adult learning theory (Knowles, 2005) and evidence-based practice provided the underpinning for the development of the training programme. Knowles (2005) emphasised that adult learning is self-directed and adults expect to take responsibility for their own learning. They also bring their own stock of experience and knowledge which needs to be appreciated within the context of learning. An overview of the content of the educational programme is provided in *Table 1*.

A sample of 47 community nurses ( $n=47$ ) took part in the study from one primary care trust. Full participation was defined as taking part in a non-participant observation visit to a patient requiring wound care before and after attendance at the educational programme, and completing a questionnaire before and after the event. Seventy-nine patient visits were observed, 47 before and 32 after the educational intervention. Statistical power analysis was used to estimate the sample size required to adequately test the hypothesis. To detect a medium effect size, with 85% power at the 5% level, allowing for attrition, a minimum sample of 31 participants was required. All community nurses were, however, invited to take part to ensure an inclusive approach.

Community nurses' knowledge was examined using a questionnaire in relation to

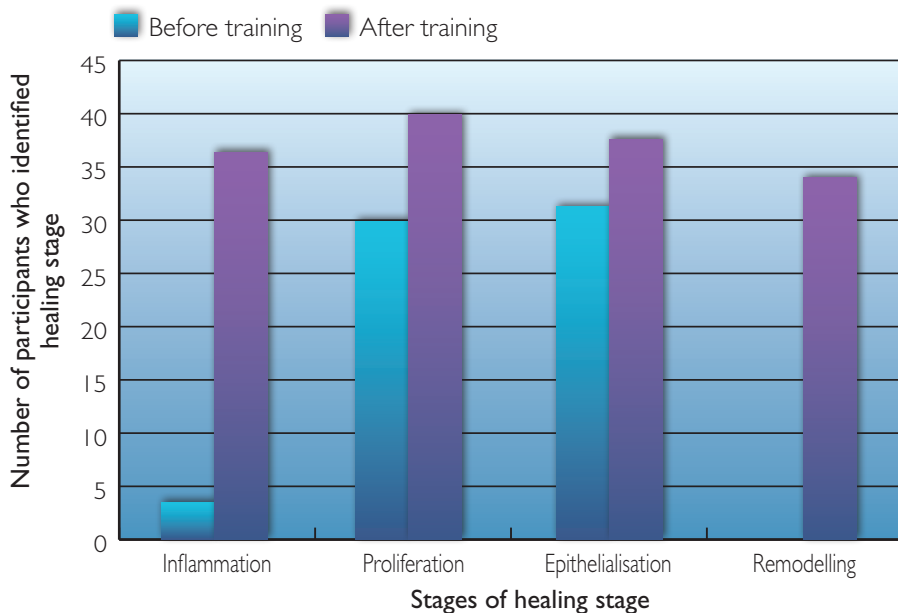


Figure 1: Number of nurses who correctly identified the stages of wound healing before and after training.

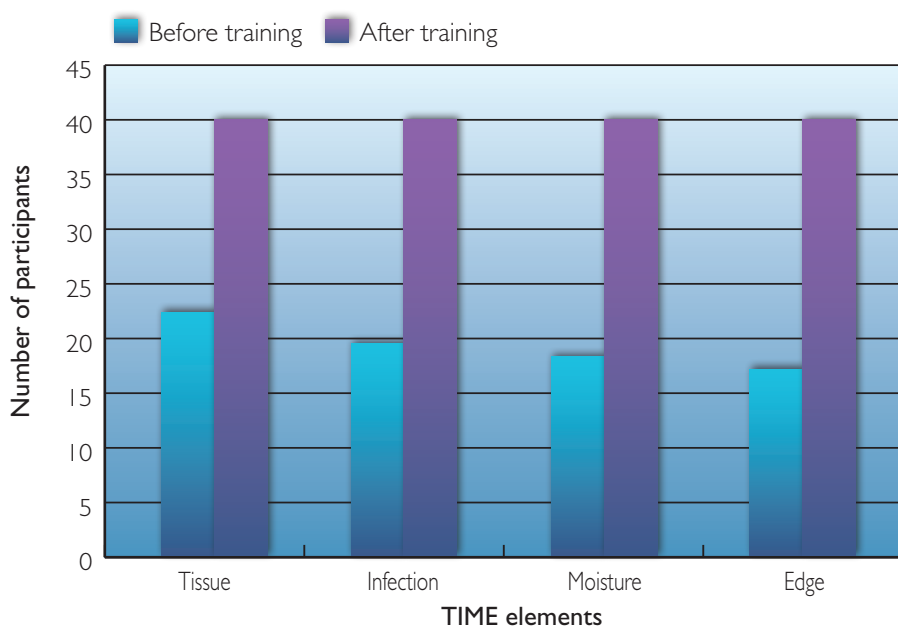


Figure 2: Number of participants who were able to define TIME before and after training.

the following key areas:

- ▶▶ Physiology of wound healing
- ▶▶ Knowledge of WBP and the TIME framework
- ▶▶ Patient assessment
- ▶▶ Wound assessment
- ▶▶ Identification and management of the elements of TIME.

Wound care practice was examined by non-participant observation and recording of information from the patients' clinical records in relation to the following key areas:

- ▶▶ Patient assessment: general and specific to wound type

- ▶▶ Identification and treatment of the underlying cause
- ▶▶ Wound assessment
- ▶▶ Identification, recording and treatment of TIME-related problems
- ▶▶ Referral pathways.

The questionnaire and observation schedule were peer reviewed by the International Advisory Board for WBP to increase reliability and validity and piloted in another local primary care trust. The results were analysed using the computer software Statistical Package for Social Sciences (SPSS) version 14.0.

This was a single site research study as part of a PhD in Professional Practice at City University and was peer reviewed. Ethical approval was obtained for the study and the community nurses and their patients who took part all gave their consent.

### Results

Forty-seven community nurses from clinical bands five to seven took part in the study; 32% were band seven, 11% were band six and 57% were band five nurses. A total of 79 patient visits for wound care treatments were observed. The most common wound type seen was leg ulceration, accounting for 80% of the visits. The results showed that knowledge and practice improved significantly after the delivery of an educational programme based on the concept of WBP and the TIME framework. Pre-test knowledge scores of mean=25.35, SD 7.19 and post-test scores of mean=42.08, SD 3.63 were shown. A significant improvement in knowledge was noted ( $t[39]=17.37, p<0.001$ ). The results from observation visits were analysed for changes in nurses' practice in patient assessment and wound assessment, using the TIME framework before and after the educational intervention (with pre-test scores of mean=21.77, SD3.94 and post-test scores of mean=28.91, SD3.65). A significant improvement was noted in practice ( $t[32]=7.12, p<0.001$ ). Scores for patient assessment and wound assessment were analysed independently and the following results were found. Pre-test scores for patient assessment were mean=19.5, SD 3.36, and post test scores were mean=25.06, SD 3.57. A significant improvement was noted in the way in which community nurses assessed patients ( $t[32]=5.42, p< 0.001$ ). Nurses' practice in wound assessment and measurement also improved after training and this was found to be statistically significant ( $z=4.502, p< 0.001$ ).

### Knowledge

Nurses' knowledge of wound healing was found to be poor before the educational intervention and most nurses were only able to identify two stages of wound healing before training. This improved significantly after training ( $z= 5.667, p<0.001$ ), as shown in Figure 1. Before the educational intervention only 18 (45%) of the community nurses involved in the study were able to define the concept of



WBP, but this improved to 35 (88%) after training. Likewise, the TIME framework was poorly understood before the educational intervention but this improved significantly after training (Figure 2). Community nurses' knowledge in each element of the TIME framework improved.

#### Tissue

Nurses' knowledge of debridement methods was poor before training, with many nurses focusing on autolytic debridement. After training they were able to identify and categorise more methods for wound debridement. Knowledge improvement in this area was found to be statistically significant after the educational programme ( $z=4.833, p<0.001$ ).

#### Infection

Nurses' knowledge of the signs and symptoms of wound infection improved significantly ( $z=4.627, p<0.001$ ). Nurses were also able to differentiate between local and systemic infection and appropriate treatments. Ten (25%) of the community nurses involved in the study incorrectly stated that they would use oral antibiotics to treat local infection before the training, but with none recommending this practice after training.

#### Moisture

Community nurses gained an increased understanding of the need to treat the underlying cause of the problem when managing wound exudate, as a result of the educational intervention. There was an increase in the number of respondents who identified compression therapy as a treatment for the M in the TIME framework. Before training, only seven (17%) nurses identified this as a treatment for excess exudate, but this improved to 30 (75%) after training. Given that 80% of the patients observed had leg ulceration, this is an important outcome. Fourteen (35%) of the nurses were able to make association between the M and the I of the TIME framework, by identifying infection as a possible cause of increased exudate.

#### Edge

Two issues were examined in relation to nurses' knowledge of the E in the TIME framework: wound evaluation and identification of abnormal wound edge. The nurses stated that the most common

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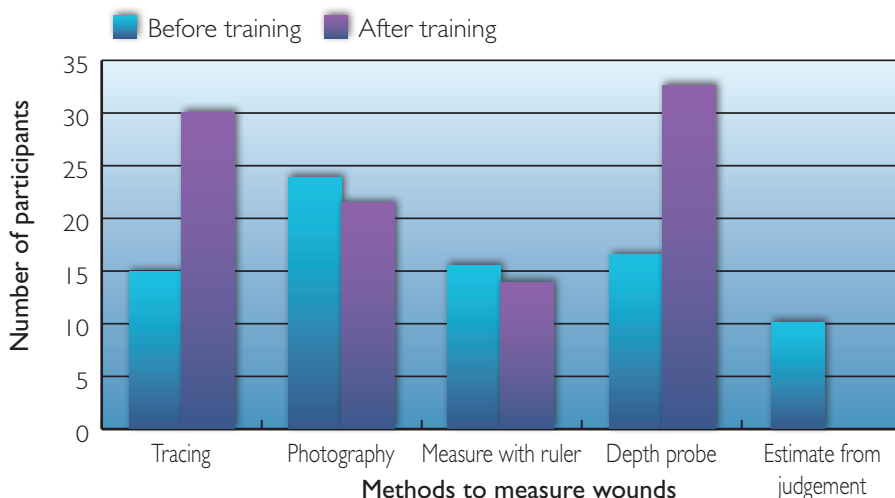


Figure 3: Methods identified to measure wound progress.

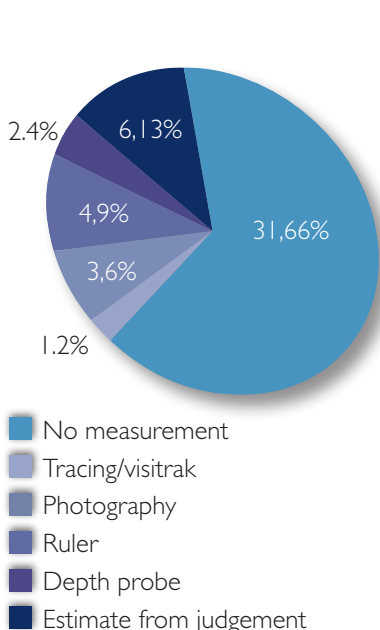


Figure 4: Wound measurement method before training.

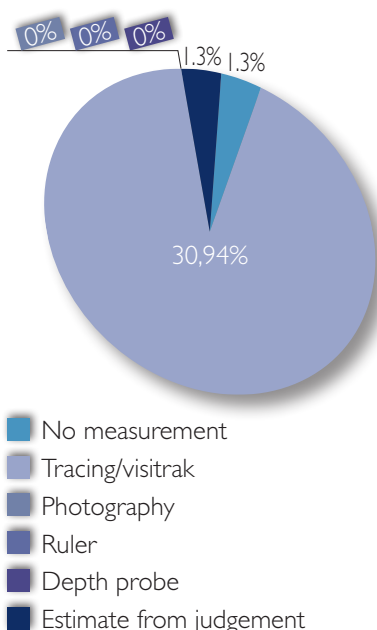


Figure 5: Wound measurement method after training.

method they used to monitor healing was wound photography (24, 60%) and use of depth probes (17, 42%). However, this was not supported in observed practice, with few patients having any form of wound measurement or an initial wound photograph. After training the methods stated were tracing (30, 75%) and use of depth probe (33, 82%) (Figure 3), and these findings were consistent with observed practice. Community nurses' knowledge in relation to wound edge problems was poor before training. Only three (7%) nurses were able to identify a raised wound edge and four (10%) undermining in case report examples. This improved significantly after training with 33 (83%) being able to identify

a raised wound edge and 34 (85%) to identify undermining.

#### Practice

Accurate assessment and diagnosis of a patient with a wound is essential for good wound care practice. Evidence from the literature shows that assessment is poor, as is the documentation of that assessment (Coulliet, 2001). A total of 79 non-participation observation patient visits were undertaken, 47 before the educational intervention and 32 after. Comparisons were made between the assessment of patients by nurses before and after training (pre-test scores being mean=19.5, SD 3.36, and post-test scores, mean=25.06,

SD 3.57). A significant improvement was noted ( $t[32]=5.42, p<0.001$ ). Generally, the detail and level of assessment undertaken by the community nurses in this study was good, facilitated by the nursing notes which were detailed. However, assessment of quality of life (QoL) issues was poor; with 13 (27%) nurses demonstrating evidence of assessment of QoL before training and 16 (48%) after training. In particular, assessment of pain, including pain at dressing change was poor. The most notable improvements in practice were in relation to wound assessment and identification and management of related TIME problems. Only 20 (42%) patients had a wound assessment form completed before training, but this improved to 31 (97%) after training, demonstrating a statistically significant improvement ( $p<0.001$ ). In terms of wound measurement, only 16 (34%) had some form of wound measurement taken before training (Figure 4), but again this improved after training to 31 (97%) (Figure 5). The use of wound tracing using grids and measuring devices became standard practice after the training programme.

#### Tissue

Identification, documentation and management of TIME-related problems was poor before training. Twenty patients were identified as having non-viable tissue in the pre-training observation group, yet only 16 (34%) had this recorded in their notes as a problem. After training, 20 (62%) patients seen had this problem and 100% had it identified and documented. The most used method for debridement was autolytic debridement before and after training. However, a number of patients were having larval therapy and others had been referred for sharp debridement after training.

#### Infection

Ten (21%) patients in the pre-training observed group had clinical signs and symptoms of infection, as identified using the recommended criteria for infection (Cutting et al, 2005). From this group seven patients were identified as having local infection and three as having systemic infection. Seven (15%) of these patients had been prescribed oral antibiotics. In the post-training patient group, nine (28%) patients were identified as having clinical signs and symptoms of infection, of which eight (25%) were local and one (3%)

systemic, with appropriate prescribing of oral antibiotic therapy (Figure 6). There was also a reduction in the number of wound swabs taken for culture and sensitivity after training, with 12 (25%) patients having had a swab taken before training and none having a wound swab taken after training. This showed that nurses were more likely to use clinical judgement to make a diagnosis of infection instead of laboratory diagnosis. Post-education nurses were also using their increased knowledge to differentiate between local and systemic infection which leads to a reduction in antibiotic use. There was a reduction in the use of topical antimicrobial dressings from 28 (60%) in the pre-training observed group to 14 (43%) in the post-training group. This was reflected in a reduction in wound care prescribing costs.

#### Moisture

A significant number of patients in the study had a moisture balance problem. A total of 69 patients presented with moderately to highly exuding wounds. Pre-training, the community nurses used descriptive terms such as 'exudate ++' and 'leaking' to describe the wounds. Post-training, more objective terms such as high, moderate and low were used in the wound assessment and evaluation forms. Appropriate absorbent dressings and compression therapy were in use.

#### Edge

Thirty (63%) patients had evidence of edge advancement and 17 (36%) were observed or reported to have a non-healing wound in the pre-training observed patient group. After training, 25 (78%) had evidence of edge advancement and eight (25%) were non-healing. Again, this element of practice was poorly identified and documented by the nurses, which made it difficult to assess progress. Only five (29%) had a non-healing wound recorded as a problem in the clinical notes, and only three (17%) had been referred for specialist advice. After training all eight (25%) of those patients identified as non-healing had the problem recorded and specialist referral in place.

#### Discussion

Wound bed preparation as a concept has been well accepted and utilised by wound care practitioners and is recognised as a global concept which provides a



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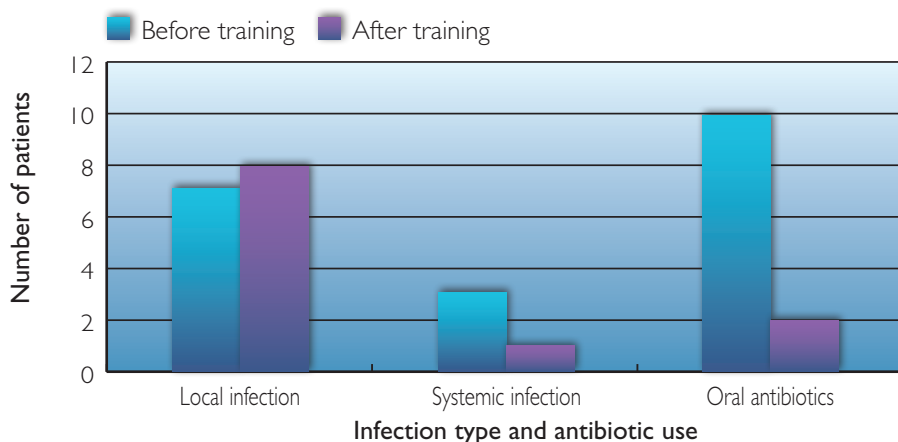


Figure 6: Infection and antibiotic use.

structured approach to wound care. The TIME framework is a tool developed to operationalise the concept in clinical practice, and has been used in this study for the purpose of developing research, education and practice. As healthcare professionals we need to be constantly seeking ways to improve care for patients and ensure positive outcomes through practice, research and education. The ultimate goal of educating healthcare professionals must be to improve patient outcomes. Despite education resources, many patients are still not benefitting from the implementation of good wound care practice (Flanagan, 2008). It is important to evaluate what impact, if any, education has on knowledge and the application of that knowledge to practice. To do this, clinicians need to directly observe practice and benchmark against agreed best practice. There are tools that can facilitate this process, for example, the *Best Practice Statement: Optimising wound care* (Wounds UK, 2008).

The study does acknowledge the difficulties of applying an experimental design to the practice setting due to the number of variables that need to be controlled. While this research project made every effort to control these variables by using structured tools that had been subject to peer review and piloted, and statistical analysis to analyse the data, due to the nature of real world research it was not always possible to control all the variables (Robson, 1998).

The healthcare environment is changing and all these changes call for practitioners to develop new knowledge and skills. Tissue viability services need to be able to demonstrate evidenced-based

quality outcomes not only from their own direct patient contacts, but from other nurses who provide wound care in their organisations. Getting evidence into practice can be difficult, and adoption of new ideas, practices and artefacts is influenced by the interaction among the innovation, adopter and the environment. Change in practice is more likely to be successful where the change is compatible with existing structures, can be seen to have an advantage and can improve outcomes.

Changing practice is challenging, but sustaining change can be difficult and involves integration of the changes into everyday practice. In an attempt to ensure continued use of the TIME framework and appropriate selection of treatments based on the identified barriers to healing, the tissue viability service developed a wound dressing formulary for use across primary and secondary care, based on the TIME framework. The framework has also been incorporated into the tissue viability in-house educational programme. The results of this experimental study demonstrate the significant improvements that can be achieved in community nurses' wound care knowledge and practice when the TIME framework is incorporated into an educational programme. Practice improvements have been maintained as demonstrated through ongoing wound care audits both in wound care clinics and community nurses' home visits. **WUK**

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## Key points

- ▶▶ TIME framework is a useful tool for delivering wound care education and can make significant improvements to wound care practice.
- ▶▶ The concept of WBP and TIME needs to be considered within the context of total patient care and should include a comprehensive assessment of the patient.
- ▶▶ The ultimate goal of educating healthcare professionals must be to improve patient outcomes
- ▶▶ Tissue viability services need to be able to demonstrate evidenced-based quality outcomes not only from their own direct patient contacts, but from other nurses who provide wound care in their organisations.

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