WORLD UNION
OF
WOUND HEALING SOCIETIES

STRATEGIES TO REDUCE PRACTICE VARIATION IN WOUND ASSESSMENT AND MANAGEMENT:

The T.I.M.E. Clinical Decision Support Tool

WORLD UNION OF WOUND HEALING SOCIETIES

CONSENSUS DOCUMENT

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FOREWORD

There are many reasons for practice variation in wound management. There is no universal solution to reducing or removing variation in clinical practice, so greater standardisation may be required to help structure how clinicians assess and manage wounds.

Effective assessment is a key aspect of setting patients and their wounds on the path towards an optimal or appropriate outcome. An International Core Expert Working Group met in September 2019 and explored the many factors that influence standardisation of care. For the purposes of this WUWHS consensus document, the international core expert working group chose to specifically consider use of the T.I.M.E. Clinical Decision Support Tool (T.I.M.E. CDST) as a means of standardising the assessment and management of wounds in order to reduce practice variation.

The T.I.M.E. CDST has evolved from the original TIME concept, which was developed by Schultz et al[1], and provided a structured approach to wound bed preparation. The concept considers four aspects – the type of **T**issue within the wound, the presence of **I**nfection and Inflammation, the **M**oisture balance and the appearance of the **E**dge of the wound.

To expand the value of TIME to clinicians caring for patients with wounds, a clinical decision support tool has been developed to embed the TIME concept firmly within recent advances in knowledge base and to offer a holistic assessment of the patient and their wound(s)[2] through the initial ABCDE approach. The ABCDE approach translates the identification of the underlying causes and patient needs into practice (Appendix A – T.I.M.E. CDST product-specific and non-product-specific versions).

This document seeks to help clinicians support those who do not have specialist wound training to accurately assess patients and their wounds and arrive at a broad-based, systematic rationale for their selection of local wound treatments that will ultimately help reduce variations in clinical decision-making.

Zena Moore and Dot Weir
Chairs, Expert Working Group

WOUND MANAGEMENT: A GLOBAL CHALLENGE

Wounds present a global challenge, growing both in number and impact within ageing populations. The 2017 Global Burden of Disease study[3] identified that there were over 4 million people with new pressure ulcers/injuries across 195 countries in 2017, with other wounds included as part of an 'other skin and subcutaneous diseases' category affecting 570 million people in 2017. Between 1990 and 2017, skin and subcutaneous diseases (including wounds) increased across all geographic areas (except Central and Eastern sub-Saharan Africa), and the estimated burden of global disability imposed by pressure ulcers increased by 45.2%[3].

In an ideal world, all wounds would be evaluated by clinicians with both the expertise and specialist knowledge required for optimal wound management and healing. All too frequently this ideal is not realised[4].

Lack of access to appropriately trained staff leads to patients receiving sub-optimal wound care.

Unfortunately, gaining access to experienced health professionals with competence in wound management is a common challenge; data in relation to lack of local wound care expertise have been reported in the Czech Republic, Belgium, Italy, Portugal, Sweden and the United Kingdom[5,6].

Extreme variations in clinical practice were identified in the Burden of Wounds Study, which reported that many patients with chronic wounds received poor assessment and inaccurate diagnosis, underuse of evidence-based practice and wide variations in the quality of services provided[7]. Gaps in the provision of best practice wound care were also reported for leg ulcer management, where only 16% of patients with leg ulcers or diabetic foot ulcers had ankle-brachial pressure index (ABPI) readings recorded in their records[7]. Sub-optimal wound management negatively impacts on patients and health services in several ways including:

- Impaired healing and extended time living with a chronic wound
- Elevated risk of adverse events
- Reduced quality of life
- Increased dissatisfaction with care for both healthcare professionals and patients
- Increased costs of healthcare.

There is an urgent need and opportunity to reduce variation to improve patient outcomes.

REDUCING PRACTICE VARIATION

Reducing practice variation in wound management requires the use of effective holistic assessment, leading to appropriate diagnosis and the adoption of evidence-based methods of practice. To achieve this, several interlinking steps are proposed (Figure 1).

The key challenge to reducing practice variation in wound management is to improve the skills of all healthcare professionals in a systematic, consistent way.

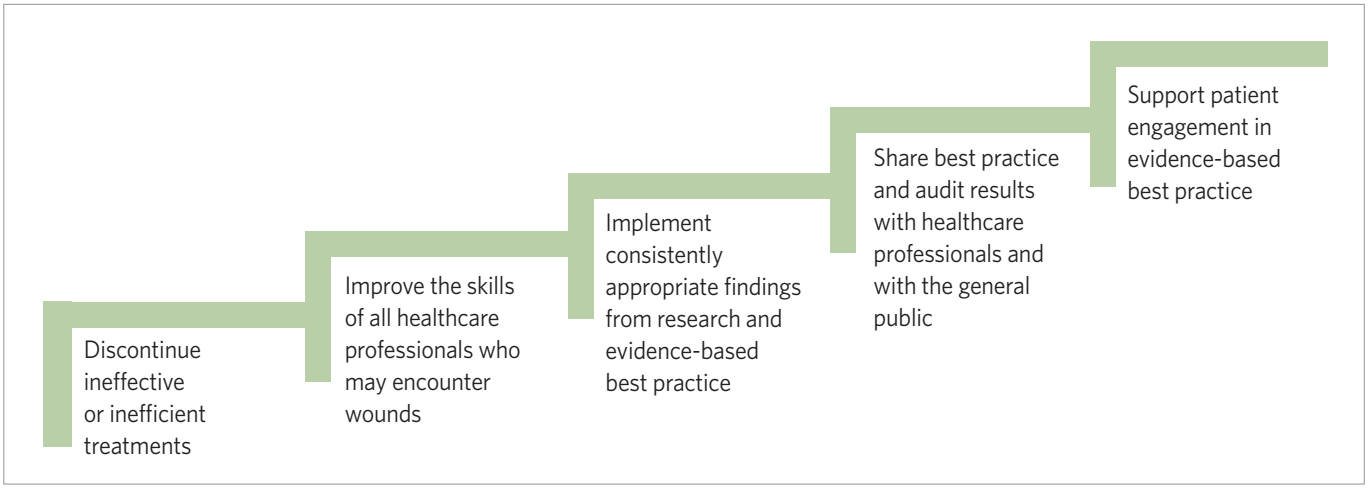


Figure 1 | **How to reduce practice variation in wound management**[8]

WHY HOLISTIC ASSESSMENT IS IMPORTANT?

A key element of holistic wound assessment is the patient, and not just the wound[9]. Effective holistic patient and wound assessment is a fundamental aspect of wound management, providing a common vocabulary to aid communication between clinicians around the status of all wounds. Full patient wound assessment:

- Addresses the underlying cause(s)
- Identifies the barriers in wound healing at the point of assessment and every evaluation
- Allows for the documentation of wound status
- Facilitates tracking changes in the patient and their wound(s) over time
- Provides a foundation for the collection of wound progress and outcome data
- Informs appropriate treatment planning
- Enables the patient and their carers or families to recognise and appreciate the progress or deterioration of their wound
- Provides data for policy-makers.

Since the 1980s, at least 30 wound assessment frameworks (referred to as tools herein) have been described[9-37], each intended to help guide wound assessment and to record wound progression or deterioration.

Reasons for the multiplicity of wound assessment tools include:

- The development of assessment tools for specific wound types, for example pressure ulcers/injuries[15-17,35], leg ulcers[12,20], diabetic foot ulcers[31], eye injury[34], war wounds[36] and malignant wounds[37]
- Reflection of changes in our understanding of wound healing over time
- Lack of consensus over the most appropriate factors to include in a general wound assessment.
- Multiple stakeholders and special interest groups developing assessment tools.

Wound assessment tools have migrated from being a focused description of the wound to enabling holistic assessment and management, including:

- Preferences and concerns of patients
- Diagnosis and confirmation of the wound aetiology
- Underlying cause(s)
- Barriers to healing
- Appropriate treatment selection
- Evaluation and reassessment.

Comprehensive wound assessment provides the foundation for effective wound management.

However, the increasing sophistication of wound assessment tools is largely meaningless if clinicians do not use these aids and use them appropriately. Clinicians seek assessment tools that are unambiguous, easy to teach, easy to implement by both healthcare professionals and carers, able to guide clinicians consistently at each wound assessment[38], and comprehensive, covering all relevant factors that impact on a patient with a wound.

A total of 40% of surveyed participants at an international wound conference did not use wound assessment tools.

WHO USES WOUND ASSESSMENT TOOLS?

Most health care professionals are not specialists in wound management ('non-specialists') and, as such, their awareness and performance of thorough and accurate wound assessments may be limited. Additionally, it is concerning that the adoption of wound assessment tools by specialist wound nurses is incomplete and variable[38]. It is important to raise awareness of this gap in practice and to find ways of encouraging the use of validated assessment tools to promote consistency in care.

There are many wound assessment tools but they are under-used in practice by specialists and non-specialists.

Who are non-wound care specialists?

Most wounds are seen, at least initially, by non-wound care specialists[7,39]. Identifying clinicians who may be described as 'non-specialists' can be based on several factors that cannot be viewed in isolation (Box 1).

Box 1 | Factors to consider when determining specialist and non-specialist healthcare professionals

- Job title[40,41]
- Job location[42-44]
- Point of patient contact[45]
- Clinical competency[46]
- Transferability of skills[47]
- Deliberate practice[40].

Competency

Although the core competencies for specialist wound care nurses has been established[48], there is currently no reported separation of the competencies between non-specialist and specialist nurses in wound management, as there are for other specialist nursing groups such as infection control nurses[46]. From a potential list of 96 competencies, 77 were considered to be core competencies for specialist wound care nurses, with five competencies rated by over 95% of experts to be fundamental to specialist wound care nurses (Box 2).

A wound care specialist will be able to demonstrate the application of a high level of wound care knowledge with regard to factors such as wound aetiology, underlying causes of wounds and available treatment options.

Box 2 | Five competencies rated by over 95% of experts to be fundamental to specialist wound nurses[48]

- Application of a high level of wound care knowledge with regard to factors such as wound aetiology, underlying causes of problem wounds and treatment options in patient care
- Ability to use appropriate terminology while taking into account the intended recipient
- Ability to provide care in a responsible manner
- Ability to protect information provided by or about patients, keeping it in confidence and divulging it only with the patient's permission except when otherwise required by law
- Commitment to patients, profession and society through ethical practice.

Defining a non-specialist clinician is challenging, but a key feature is that the non-specialist has less opportunity and time to perform 'deliberate practice', i.e. less hands-on experience with wounds.

Deliberate practice

The main difference between specialists and non-specialists has been identified as the fact that specialists have greater opportunity to perform so-called 'deliberate practice'[41]. There are four practical principles of deliberate practice as it relates to clinical skill acquisition (Box 3).

Competence in wound management increases as the number of wounds treated each week also increases[49]. In the case of leg ulcer management, specialists typically spend 15 hours each week, while non-specialists spent only 7 hours[41].

Box 3 | Practice principles to describe deliberate practice as it relates to clinical skills acquisition[50]

- Repetitive performance of intended cognitive or psychomotor skills
- Rigorous skills assessment
- Specific information feedback
- Better skills performance.

WOUND ASSESSMENT TOOLS

Wound assessment tools with numerical outputs

There are 15 wound assessment tools that provide a number to describe the status of the wound when the assessment is completed[15-24,26,31,32,34,36]. The majority of these tools only consider factors within the wound and the surrounding skin, with some tools addressing patient factors including pain, age, anxiety[51], mental state, self-sufficiency, nutrition (including body mass index), predisposing disease and overall quality of life[20,26,32,34].

The variability between the items included in each numerical output tool strongly suggests a lack of consensus over the key elements of a comprehensive wound assessment.

Wound assessment tools with no numerical output

These tools guide clinicians to consider several aspects of the patient and their wound rather than deriving a wound score.

A wide range of factors that could form the basis of a comprehensive wound assessment have been identified[10] (Appendix B). These factors were reviewed by an expert panel and consensus gained for their inclusion/exclusion within a proposed minimum data set (MDS) of 30 items[10]. Seven additional questions have been proposed as part of the comprehensive wound assessment form[33].

Other patient- and wound-related factors within other non-numerical wound assessment tools include, for example, wound colour[27,35], wound itch and odour[52], wound contraction[30], sharp debridement[30], requirement for wound cleansing[28], tissue induration[29], wound debridement[14], bleeding and tissue swelling[37], and skin protection and rehydration[11].

Non-numerical tools guide clinicians to consider several aspects of the patient and their wound rather than deriving a wound score.

VALIDATING ASSESSMENT TOOLS

Validating wound assessment tools

There are significant gaps in understanding the facets of validity of common wound assessment tools[53,54]; however, validity and reliability of assessment tools are important steps (Figure 2). There are several facets of validity of a clinical tool (Table 1).

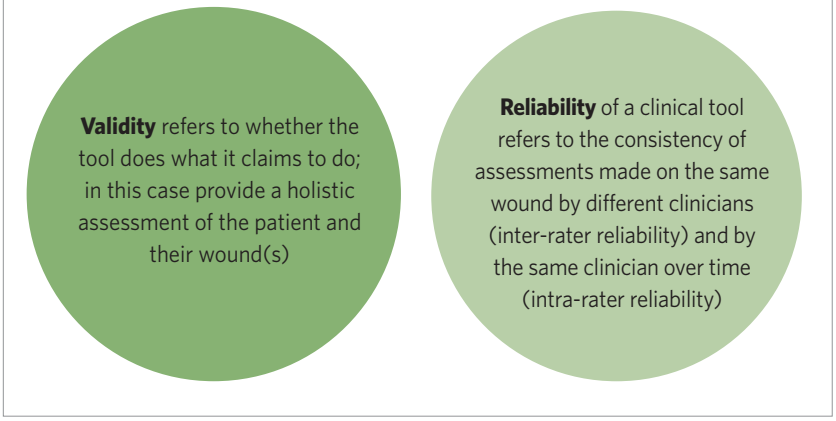


Figure 2 | Validity and reliability

Table 1 | Facets of the validity of a clinical tool

Face validity	Does the tool appear likely to help assess a wound?
Content validity	Is the content of the tool appropriate and comprehensive?
Construct validity	A construct is a complex set of skills, proficiencies and attitudes that are intended together to represent 'wound assessment': is the construct comprehensive, and does it perform in a similar manner to other constructs of wound assessment?
Criterion validity	How does the tool perform against a 'gold standard' wound assessment tool?
Concurrent validity	How does the tool perform against other wound assessment tools where no gold standard tool exists?
Predictive validity	How well does the tool help to predict future events such as wound healing?

TIME CONCEPT AND EVOLUTION

TIME was reported to be the most commonly used wound assessment tool among clinicians attending a European wound care conference[38]. TIME was first described in 2003[1] as a mnemonic to help clinicians focus upon and manage local barriers to wound healing to help prepare the wound bed for repair, also known as wound bed preparation (WBP).

TIME encourages active consideration of the tissue types present in the wound bed, inflammation and infection, moisture balance and the wound edge[1]. Originally, the E represented non-migration of the epidermis, but in 2004 was changed to non-advancing or undermined wound edge[55].

Since the introduction of the TIME concept, many new interventions have emerged, and the understanding of the biological basis for wound healing has expanded. Despite these rapid changes, both the TIME concept and WBP remain relevant today[56,57], and the TIME concept has become an established and successful tool to support WBP. The TIME mnemonic has been expanded to take account of changes in knowledge (Table 2).

Table 2 | Additional components of TIME concept variations

TIME (S)	Includes appearance of the skin[12]
TIME-H	Includes patient age, mental state, self-care, nutrition and predisposing disease[26,58]
TIMERS	Includes the addition of repair and regeneration, encouraging wound closure through the use of advanced wound therapies including hyperbaric and topical oxygen therapy and bioengineered technologies[25]. The final addition to TIMERS covers social or patient-related factors that may strengthen patient engagement with therapy
T.I.M.E. Clinical Decision Support Tool (T.I.M.E. CDST)	Includes a five-step clinical decision support tool that combines the wound bed preparation approach with holistic patient and wound assessment to enable assessment, selection of appropriate treatments and determine short-term goals[2]

The TIME concept is a well-established mnemonic to provide a structured approach to wound bed preparation.

Box 4 | The optimal wound assessment tool?[64]

- Details and characteristics of the wound
- Wound site
- Wound duration
- Wound aetiology
- Wound measurement
- Tissue type
- Exudate
- Surrounding skin
- Pain
- Signs of infection
- Patient details.

The T.I.M.E. Clinical Decision Support Tool (T.I.M.E. CDST) has been reported as a potential enabler of the TIME concept in practice[2,59-63]. The consensus group agreed that the T.I.M.E. CDST could be integrated as a global tool with supporting materials that address the challenges of successful adoption.

An optimal wound assessment tool should include relevant patient- and wound-related factors[64] (Box 4). The T.I.M.E. CDST incorporates all of the elements of an optimal assessment tool.

The T.I.M.E. Clinical Decision Support Tool (T.I.M.E. CDST) has been reported as a potential enabler of use of the TIME concept.

MAKING CHANGE HAPPEN: SUCCESSFUL ADOPTION OF AN ASSESSMENT TOOL

To achieve changes in wound assessment and management, the barriers to change must first be identified[65] (Box 5).

Box 5 | Five key barriers to process implementation[65]

- Lack of awareness and knowledge
- Lack of motivation
- Practicalities
- Acceptance and beliefs
- Lack of skills.

Barriers to change

Lack of awareness and knowledge

Clinicians who have limited awareness of the importance of effective wound assessment or, perhaps, lack the specific knowledge of how to assess wounds, may be more challenged when presented with a new wound assessment tool.

Wound management knowledge is generally enough to inform practice, but there is a lack of translation of nurses' theoretical knowledge of wound assessment and management into their daily practice.

Lack of motivation

Wound management is complex, and progress and rewards can be slow. Encouraging motivation to develop knowledge and to adopt new strategies is multifactorial, but two known key drivers of reduced motivation are lack of progress and extended duration of wound treatment. If, from experience, wound management is going to be both lengthy and slow, there may be little motivation for clinicians and patients to consider use of new strategies and wound assessment tools[66].

Practicalities

The practicalities of delivering care may also block new approaches to wound management[66-69] and lead to poor outcomes (Box 6).

Box 6 | Practicalities of delivering care that may lead to poor outcomes[66-69]

- Lack of time and confidence to undertake assessment
- Inequalities in the availability of competent experienced clinicians
- Lack of referral pathways
- Confusion over who is responsible for wound management
- Lack of access to advanced aggressive treatment plans when in community settings
- Frequent changes of wound treatment through failure to follow evidence-based guidance
- Lack of a consistent relationship between patient and nurse
- Lack of clarity regarding access to appropriate equipment, such as Doppler ABPI, advanced wound dressings and other medical devices, such as negative pressure wound therapy
- The local environment may produce a difficult working environment, such as poor lighting, positioning or unhygienic conditions in patients' homes.

Acceptance and belief

Wound assessment and management may be impeded where clinicians disagree over how to assess wounds. It is well-known that, even among experts, there is uncertainty and disagreement surrounding the interpretation of assessment parameters[10].

Skills to encourage deliberate practice

Acquiring skills requires initial training, and sustaining these skills is achieved through deliberate practice and spreading of these skills to colleagues[67]. A lack of skill in wound assessment and management may reduce the confidence of patients, carers and their families about the treatment[68].

Non-specialists may encounter wounds infrequently and have little opportunity to regularly apply their skills.

OVERCOMING BARRIERS TO IMPLEMENTATION

Overcoming barriers to adopt new wound assessment tools, such as T.I.M.E. CDST, requires a multiple-pronged approach (Figure 3).

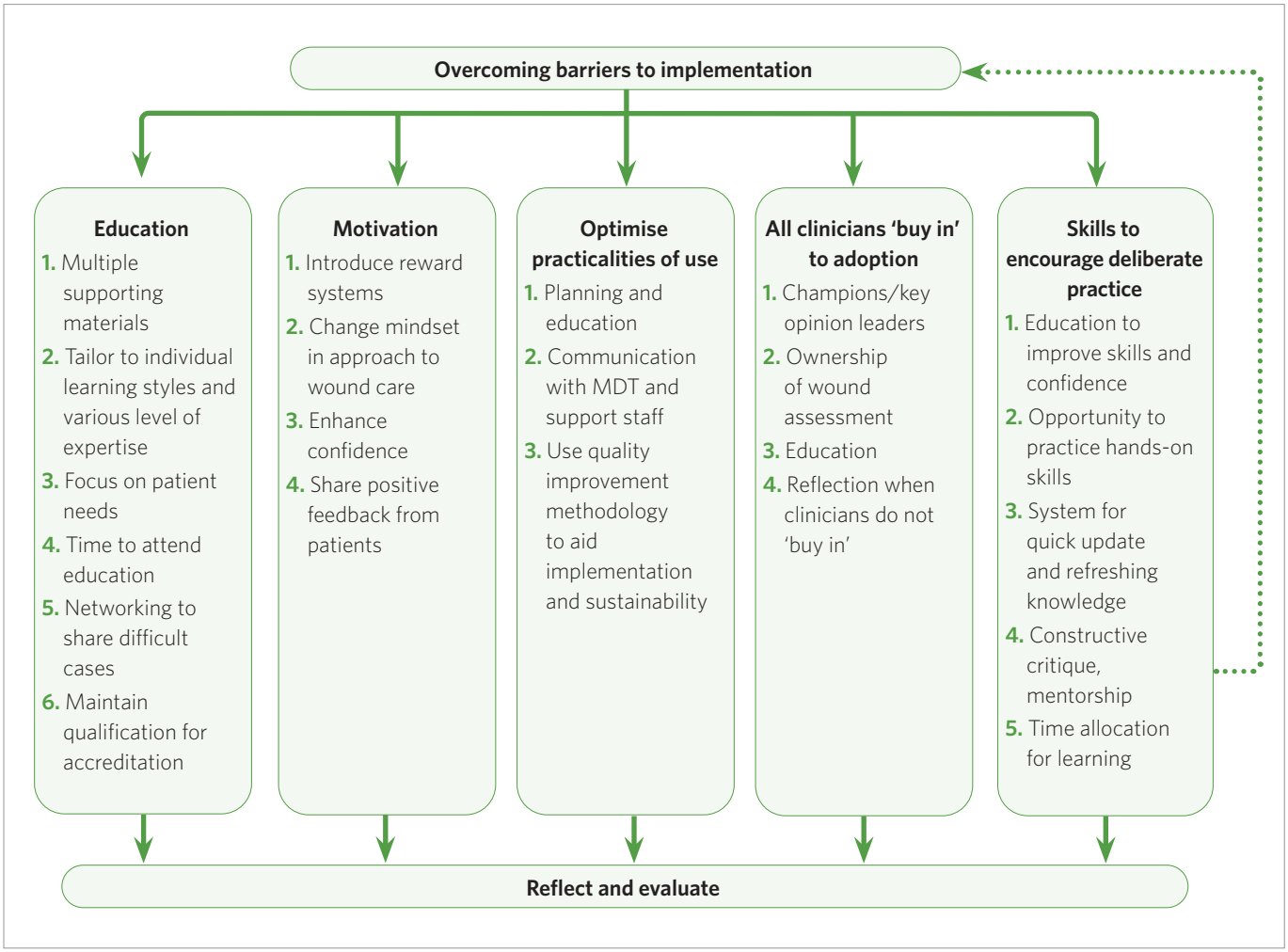


Figure 3 | Pathway to overcome barriers when implementing a new tool or initiative into practice

In terms of multiple educational strategies, Table 3 illustrates a summary of effectiveness of different educational initiatives by the United Kingdom National Institute for Health and Care Excellence (NICE)[65].

Each strategy should be available with appropriate content tailored to the needs of the individual clinician, accommodating various levels of expertise from wound novice to wound expert (Figure 4)[70]. The Dreyfus model of skill acquisition is relevant to nursing, whereby clinicians acquire skills through a progression from novice to advanced beginner then becoming competent, before achieving proficiency and finally expert status[70].

Figure 4 | Dreyfus model of skill acquisition progression[70]

Individually tailored educational strategies should be developed that support clinicians to gain proficiency in wound assessment and management.

Table 3 predates the expansion of online educational initiatives, such as websites, podcasts and mobile applications (apps). The move to online initiatives is designed to support healthcare professionals to have access to the latest, most up-to-date evidence-based care at the point of care, and an app is deemed to be the most efficient way to deliver online support[71] (Box 7). Effective online wound management education and practical hands-on simulated activities allow for the integration of multiple learning styles to match the preferences of individual learners (i.e. visual information, speech, sounds and touch)[72].

Barriers to the implementation of wound assessment tools can be overcome partly through effective education for healthcare professionals that is personalised to individual learner preferences.

Box 7 | The ideal wound-related clinical assessment app should:

- Be interactive
- Be evidence-based with up-to-date information
- Be precise and succinct
- Be integrated (can speak to other tools)
- Be adaptable for workplace and local formulary
- Include FAQs with solutions, red flags and prompts for action
- Include photos for reference and interactive case studies
- Take photos of wounds and provide advice.

Table 3 | Effect of educational initiatives in healthcare[65]

Initiative	Impact on clinicians and patients					
Educational materials (e.g. booklets, on-line tools, journal supplements)	✓ Raise awareness of the desired change	✓ Modest changes may be important if sustained in everyday practice	✓ Relatively low-cost, available in low-resource conditions	✦ Formats can help or impede behaviour changes	✦ Most effective when combined with other educational methods	✦ Clinicians must read and recognise that change is needed
Educational meetings	✓ Greater interactivity, more effective at changing behaviour	✓ Interactive workshops are effective in changing behaviour	✓ Provides networking with peers	✦ Conferences and lectures less effective in making change happen		
Educational outreach visits (support provided in clinicians' workplace)	✓ Effective in changing some practice (prescribing, delivery of prevention and management of common clinical problems)	✦ Visiting more than once increases effectiveness	✦ Identity of the visitor may impact effectiveness	✦ More effective if combined with reminders and interventions aimed at patients	✦ More effective if tailored to individual barriers and situations	✦ Can be expensive and time-consuming
Key opinion leaders	✓ Effective way of disseminating information	✦ Can be difficult to identify the most appropriate key opinion leaders				
Clinical audit and feedback	✓ Positive way of generating change	✓ Clinically rich data most interesting to clinicians	✦ More effective if staff have an active role in audit	✦ More effective if feedback delivered by a respected person	✦ More effective with timely feedback	✦ Effective when combined with educational materials and meetings and financial incentives
Reminder systems	✓ Effective in changing behaviour	✓ Computer-aided decision support tools can be effective in changing prescribing and delivery of preventive care	✦ Increasing reminder frequency increases effectiveness	✦ Most effective if given at point of decision making	✦ Established staff benefit less than trainees	✦ Unable to cope with complex decision-making
Patient-mediated strategies	✓ Mass media information effective in changing behaviour	✓ Planned and unplanned media campaigns are effective	✓ Provision of educational materials to patients helps change clinician behaviour	✓ Provision of educational materials to patients helps ensure concordance, leading to better outcomes, which motivates clinicians	✓ Increases patient adherence by encouraging patient engagement and self management	

Key: ✓positive aspect; ✦consideration.

INTEGRATING THE T.I.M.E. CDST IN PRACTICE

The T.I.M.E. CDST is intended to form part of the assessment performed by wound care specialists and non-specialists for patients with wounds.

There are two versions of the T.I.M.E. CDST: a product-specific version and a non-product-specific version (Appendix A). The group agreed that a product-specific version is more useful for non-specialists, so any holistic wound assessment tool needs to be easily adaptable to local formulary and product availability. In addition, a tool is more likely to be adopted when it is aligned with local organisations' own data collection systems. The T.I.M.E. CDST has been integrated in this way as part of a pilot scheme[60], as well as in teaching courses at University College level in Denmark.

The consensus group proposed that a key benefit of the T.I.M.E. CDST is its role as a teaching tool and as a memory aid for non-specialists. The T.I.M.E. CDST is a simple, 1-page prompt for practice, which is especially useful for clinicians who are not able to perform frequent deliberate practice of wound care. The T.I.M.E. CDST helps to apply the principles of WBP as part of holistic care. Additionally, recent clinical evaluations have shown its value in highlighting the knowledge gaps of non-specialists and therefore prompting areas for further education[59-63].

Perhaps the most important message for non-specialists in wound management when planning to use the T.I.M.E. CDST is that it should be used not only for patients with wounds anticipated to be challenging, but for all patients who have wounds: 'use TIME every time'.

Box 8 | Benefits of the T.I.M.E. CDST[50-63]

- It provides a structured wound management approach, supporting non-specialists in wound assessments, encouraging consistency of care and better patient outcomes
- It enhances confidence, encouraging evidence-based decisions
- It identifies the knowledge gaps of non-specialists
- It directs clinicians when to refer to other members of the multidisciplinary team
- It prompts clinicians to address the components of wound bed preparation
- It supports education
- It drives consistency once integrated into local protocols and formularies.

The T.I.M.E. CDST has been shown to support non-specialists in wound assessment and WBP.

A - ASSESS PATIENT, WELLBEING AND WOUND

The non-specialist may have limited skills to conduct a fully comprehensive patient and wound assessment and diagnose the wound aetiology. However, it is critical that, if a diagnosis is not reached, 'no diagnosis' is recorded. If this is the case, referral should be made to clinicians with greater knowledge or more access to diagnostic technology. Additionally, if a diagnosis has been determined and the wound is not responding to an appropriate plan of care, the non-specialist should again refer for further potential diagnostic testing. It is recognised that co-operation and communication among clinicians may be difficult[68,73]. Telemedicine, creating a common web-based platform, may prove useful[74].

The non-specialist should endeavour to ensure that all strategies are in place so that an accurate diagnosis is made and documented for each wound.

The assessment section of the T.I.M.E. CDST prompts the non-specialist to record wound type, location, size, wound bed condition, signs of infection/inflammation, pain location and intensity, co-morbidities, and adherence to treatment.

B - BRING IN MULTIDISCIPLINARY TEAM AND INFORMAL CARERS TO PROMOTE HOLISTIC PATIENT CARE

The T.I.M.E. CDST stresses the importance of involving a multidisciplinary team (MDT) to help manage the patient and their wound. MDT working has long been recognised as a successful approach to wound management, although direct evidence for this in practice is scant. The MDT approach has been shown to reduce the direct care costs[75] and incidence of full-thickness pressure ulcers[75], and to improve the severity of diabetic foot ulcer amputation[76], mortality, length of hospital stay, wound healing and patient quality of life. The T.I.M.E. CDST requires the management of all factors that may influence healing to be recorded; this section of the T.I.M.E. CDST may appear daunting to the non-specialist clinician but reflects the importance of inputs from the MDT in supporting the management of the patient with a wound.

Regardless of the expertise of the clinician, assistance is always useful to help inform when to refer the patient to other healthcare practitioners. Referral pathways will depend on local protocols.

C – CONTROL OR TREAT UNDERLYING CAUSES AND BARRIERS TO WOUND HEALING

The C within the T.I.M.E. CDST reiterates the importance of addressing contributory factors, ensuring that the clinician focuses on this aspect of the patient profile[2]. These could include addressing risk factors and underlying co-morbidities, such as a review of glycaemic control, as well as the use of appropriate supportive therapy (e.g. compression, offloading or improved nutrition).

D – DECIDE APPROPRIATE TREATMENT AND DETERMINE SHORT-TERM GOALS

Following the diagnosis of the wound (A), considerations of the MDT (B) and the underlying causes or barriers to healing (C), decisions (D) can be made on appropriate local wound treatment, based on the four aspects of WBP (**T**issue present in the wound, **I**nfection and inflammation, **M**oisture and the **E**dge of the wound). Appendix D presents photographic examples of a wide range of tissue types to help the non-specialist in everyday practice.

Table 4 includes key considerations to support clinicians to address the local barriers to healing as part of WBP using the TIME concept.

Table 4 | Considerations for creating supportive education to use alongside the T.I.M.E. CDST

	Knowledge checklist	Useful resources
T	❒ Viable versus non-viable ❒ Eschar versus necrosis ❒ Adipose versus attached non-viable tissue ❒ Atypical appearance of the wound ❒ Quality of granulation tissue (i.e. friable tissue, pale, hypergranulation) ❒ Adherent versus non-adherent surface substance ❒ Identification of other anatomical structures (i.e. tendon, bone)	■ EWMA (2004) *Position Document: Wound Bed Preparation in Practice*[77] ■ EWMA (2019) *Atypical wounds: Best clinical practices and challenges*[78]
I	❒ Inflammation versus infection ❒ How to recognise changes in bacterial load ❒ Localised infection versus spreading infection ❒ The presence/potential for biofilm ❒ Infection may be masked in immunocompromised patients and limbs with decreased circulation	■ IWII (2016) *Wound infection in clinical practice*[79] ■ *Consensus guidelines for the identification and treatment of biofilms in chronic non-healing wounds*[80]
M	❒ Identification of sub-optimal moisture balance (i.e. maceration, soaked dressings) ❒ Differences in exudate ❒ The importance of oedema management	■ WUWHS (2019) *Wound exudate: Effective assessment and management*[81]
E*	❒ Epibole (rolled or curled-under closed wound edges that may be dry, callused, or hyperkeratotic) and how to manage ❒ Undermined edges ❒ Unhealthy surrounding skin (i.e. hyperkeratosis, maceration, skin stripping from adhesive) ❒ Localised oedema at the wound edge ❒ Allergic signs (i.e. erythema, consistent swelling, clear exudate)	

* The **E** of the TIME concept has evolved from the initial versions of the framework. The consensus group considered the need to include the "wound **E**dge and beyond" to address care of surrounding skin, and the importance of capturing whether the wound is increasing or decreasing in size.

Clinicians should consider TIME and WBP every time they see a wound: 'use TIME every time'.

E – EVALUATE AND REASSESS THE TREATMENT AND WOUND MANAGEMENT OUTCOMES

The final stage of the T.I.M.E. CDST requires the clinician to evaluate wound progression, and return to A, B, C and D when limited or no change in the wound has been observed. Photo documentation is necessary to document status and changes. Not all wounds will progress towards healing in a linear fashion, with improvement often followed by a period of stasis or even deterioration. Using the T.I.M.E. CDST will assist the non-specialist in understanding of why these gains and losses in wound progression may occur.

The T.I.M.E. CDST directs clinicians to identify barriers to healing, to select primary and secondary interventions, and to determine short-term goals.

FUTURE RESEARCH NEEDS

Formal holistic assessment of all patients with wounds (TIME every time), not just those deemed to be 'hard-to-heal', is required to establish consistency between clinicians to increase the likelihood of positive healing outcomes. However, not all clinicians have the necessary competency or can achieve deliberate practice that defines a wound care specialist. Equipping non-specialists with tools to support decision-making can go some way to establishing consistency.

However, holistic patient and wound assessment is not simple or easy. For example, Figure 5 illustrates that many different tissue types can be present for one patient, and the patient factors have yet to be considered.

Using a wound assessment tool guides practice and improves documentation, communication and continuity of care, direction of care, setting of goals for healing and planning care, and monitoring of the healing process[64]. Without a comprehensive, documented, holistic patient and wound assessment, decisions on the selection of treatments are susceptible to variation and unpredictable changes when the wound is treated by different clinicians.

A tool such as the T.I.M.E. CDST, along with supportive education to understand the complexities of wound assessment, will allow greater guidance for clinicians. Resources in this document's appendix are available to implement wound care for all clinicians into their practice.

Figure 5 | Example of multiple tissue types present for a patient's multiple wounds (i.e. exposed tendon, necrotic tissue and healthy granulation tissue)

APPENDIX A

A non-product-specific version of the T.I.M.E. CDST

T.I.M.E. clinical decision support tool

Assess patient, wellbeing and wound

Establish diagnosis and baseline characteristics for appropriate support and comorbidities that may impact healing. Record wound type, location, size, wound bed condition, signs of infection / inflammation, pain location and intensity, comorbidities, adherence / concordance to treatment

Bring in multi-disciplinary team and informal carers to promote holistic patient care

Record referral to others such as surgical team, wound specialist nurse, dietician, pain team, vascular and diabetes team, podiatrist, physiotherapist, family carers and trained counsellor

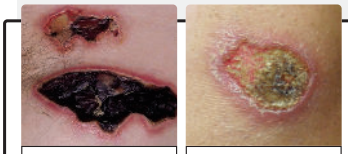
Control or treat underlying causes and barriers to wound healing

Record management plan for: systemic infection, diabetes, nutritional problems, oedema, continence, mobility, vascular issues, pain, stress, anxiety, non-adherence / concordance with offloading and compression, lifestyle choices

Decide appropriate treatment and determine short-term goals

T – Tissue non-viable[1-2]

1. ARE THERE BARRIERS TO WOUND HEALING?



Necrotic | Slough

2. SELECT PRIMARY & SECONDARY INTERVENTIONS

- Cleansing and debridement
- Surfactant, sharp / surgical or mechanical, autolytic or enzymatic, biological / larval

3. WOUND MANAGEMENT OUTCOME

- Viable healthy wound bed

I – Infection and / or Inflammation[1-2]

1. ARE THERE BARRIERS TO WOUND HEALING?

Infected | Deep infected cavity wound | Suspected biofilm

2. SELECT PRIMARY & SECONDARY INTERVENTIONS

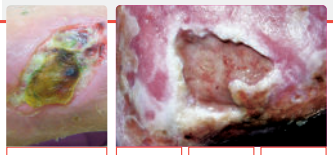
- Manage bioburden
- Antimicrobial* (topical antiseptic, and / or antibiotic therapy†)

3. WOUND MANAGEMENT OUTCOME

- Non-inflamed, non-infected wound

M – Moisture imbalance[1-2]

1. ARE THERE BARRIERS TO WOUND HEALING?



Dry | Low | Moderate | High

2. SELECT PRIMARY & SECONDARY INTERVENTIONS

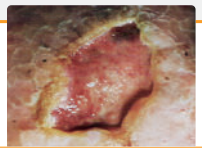
- Restore moisture balance
- Hydrogel‡, hydrocolloid
- Foam, super absorbent, gelling fibre, NPWT‡
  - Hydrocolloid, alginate
  - Alginate

3. WOUND MANAGEMENT OUTCOME

- Optimal moisture balance

E – Edge of wound non-advancing[1-2]

1. ARE THERE BARRIERS TO WOUND HEALING?



Non-advancing or abnormal wound edge

2. SELECT PRIMARY & SECONDARY INTERVENTIONS

- Promote epithelialisation and healthy periwound skin
- NPWT‡ – Atraumatic wound contact layer, cell or tissue products, skin care and adjunct treatment according to wound type

3. WOUND MANAGEMENT OUTCOME

- Advancing edge of wound

*Use appropriate secondary dressing as per your local protocol; †Where systemic infection is present, then it must be treated systemically and not just topically; ‡Negative Pressure Wound Therapy.

Evaluate and reassess the treatment and wound management outcomes

Evaluate: Record wound progression within given timelines. **Flag** if no change, go back to A, B, C and change treatment where indicated

Developed with the support of Glenn Smith[3] and Moore *et al.* 2019[4]

References: 1. Schultz GS, Sibbald RG, Falanga V, *et al.* Wound bed preparation: a systematic approach to wound management. *Wound Rep Reg* (2003);11:1-28. **2.** Leaper DJ, Schultz G, Carville K, Fletcher J, Swanson T, Drake R. Extending the TIME concept: what have we learned in the past 10 years? *Int Wound J* 2012; 9 (Suppl. 2):1–19. **3.** Smith G, Greenwood M, Searle R. Ward nurse's use of wound dressings before and after a bespoke educational programme. *Journal of Wound Care* 2010, 19(9). **4.** Moore Z, Dowsett C, Smith G, *et al.* TIME CDST: an updated tool to address the current challenges in wound care. *Journal of Wound Care*, 2019; 28(3): 154-161.

Supported by an unrestricted grant from Smith+Nephew.

An example of a product-specific version of the T.I.M.E. CDST

Smith+Nephew

T.I.M.E. clinical decision support tool

Use MolecuLight *i:X*™ wound assessment tool to measure wound surface area and evaluate bioburden level

Assess patient, wellbeing and wound

Establish diagnosis and baseline characteristics for appropriate support and comorbidities that may impact healing. Record wound type, location, size, wound bed condition, signs of infection / inflammation, pain location and intensity, comorbidities, adherence / concordance to treatment

Bring in multi-disciplinary team and informal carers to promote holistic patient care

Record referral to others such as surgical team, wound specialist nurse, dietician, pain team, vascular and diabetes team, podiatrist, physiotherapist, family carers and trained counsellor

Control or treat underlying causes and barriers to wound healing

Record management plan for: systemic infection, diabetes, nutritional problems, oedema, continence, mobility, vascular issues, pain, stress, anxiety, non-adherence / concordance with offloading and compression, lifestyle choices

Decide appropriate treatment

T – Tissue non-viable[1-2]

1. IDENTIFY THE BARRIERS TO WOUND HEALING

Necrotic

Slough

2. SELECT PRIMARY & SECONDARY INTERVENTIONS

- Debridement
- Hydrogel*
- Desloughser*
- INTRASITE◊ GEL or INTRASITE CONFORMABLE
- IODOFLEX◊ or IODOSORB◊ Range

3. WOUND MANAGEMENT OUTCOME

Viable healthy wound bed

I – Infection and / or Inflammation[1-2]

3. WOUND MANAGEMENT OUTCOME

Non-inflamed, non-infected wound

1. IDENTIFY THE BARRIERS TO WOUND HEALING

Infected

Deep infected cavity wound

Suspected biofilm

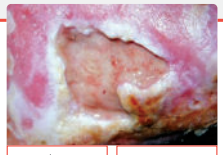
2. SELECT PRIMARY & SECONDARY INTERVENTIONS

- Manage bioburden
- Antimicrobial*
- ACTICOAT◊ Range
- DURAFIBER◊ Ag
- IODOFLEX or IODOSORB Range

M – Moisture imbalance[1-2]

1. IDENTIFY THE BARRIERS TO WOUND HEALING

Dry



2. SELECT PRIMARY & SECONDARY INTERVENTIONS

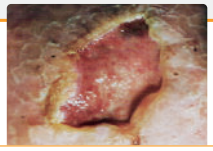
- Restore moisture balance
- Hydrogel*
- Foam , gelling fibre or NPWT†
- INTRASITE GEL or INTRASITE CONFORMABLE
- ALLEVYN◊ GENTLE BORDER, ALLEVYN GENTLE, DURAFIBER or PICO◊‡
- ALLEVYN LIFE, ALLEVYN LIFE NON-BORDERED, DURAFIBER or RENASYS◊

3. WOUND MANAGEMENT OUTCOME

Optimal moisture balance

E – Edge of wound non-advancing[1-2]

1. IDENTIFY THE BARRIERS TO WOUND HEALING



Non-advancing or abnormal wound edge

2. SELECT PRIMARY & SECONDARY INTERVENTIONS

- Promote epithelialisation and healthy periwound skin
- NPWT and skin care
- PICO or RENASYS SECURA◊ / PROSHIELD◊ Range§

3. WOUND MANAGEMENT OUTCOME

Advancing edge of wound

*Use appropriate secondary dressing as per your local protocol; †NPWT: Negative Pressure Wound Therapy; ‡Level of exudate for wounds suitable for NPWT.

Evaluate and reassess the treatment and wound management outcomes

Evaluate: Record wound progression within given timelines. Flag if no change, go back to A, B, C and change treatment where indicated

Developed with the support of Glenn Smith[3] and Moore *et al.* 2019[4]

§SECURA Range includes SECURA Moisturising Cleanser, SECURA Total Body Foam, SECURA Dimethicone Protectant, SECURA Extra Protective Cream, No Sting Skin Prep; PROSHIELD Range includes PROSHIELD Plus and PROSHIELD Foam and Spray; ‡ALLEVYN Range includes ALLEVYN LIFE, ALLEVYN GENTLE BORDER and ALLEVYN GENTLE BORDER LITE.

Reference: 1. Schultz GS, Sibbald RG, Falanga V, *et al.* Wound bed preparation: a systematic approach to wound management. *Wound Rep Reg* (2003);11:1-28. **2.** Leaper DJ, Schultz G, Carville K, Fletcher J, Swanson T, Drake R. Extending the TIME concept: what have we learned in the past 10 years? *Int Wound J* 2012; 9 (Suppl. 2):1–19. **3.** Smith G, Greenwood M, Searle R. Ward nurse's use of wound dressings before and after a bespoke educational programme. *Journal of Wound Care* 2010, vol 19, no.9. **4.** Moore Z, Dowsett C, Smith G, *et al.* TIME CDST: an updated tool to address the current challenges in wound care. *Journal of Wound Care*, vol 28, no 3, March 2019: 154-161.

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APPENDIX B

Potential factors to consider when performing a wound assessment (adapted from [10,33])	
Aspect to consider	**Assessment criteria**
General health	■ Allergies* ■ Mobility ■ Skin sensitivities* ■ Factors influencing delayed healing (e.g. systemic/local blood supply to the wound, susceptibility to infection, medication affecting wound healing, skin integrity, autoimmune disease) ■ Impact of the wound on quality of life* ■ Information provided to patients and carers ■ Patient history (surgical history, medical history, pharmacology history and current practice)
Wound baseline information	■ Number of wounds* ■ Wound location* ■ Wound type/classification* ■ Wound duration* ■ Treatment aim* ■ Planned reassessment date*
Wound assessment parameters	■ Wound size and depth* ■ Undermining/tunnelling* ■ Category (e.g. skin tear, diabetic foot ulcer, venous leg ulcer [simple or complex], pressure ulcer/injury*) ■ Wound shape ■ Wound bed tissue type* ■ Wound bed tissue amount* ■ Description of wound margins/edges* ■ Colour and condition of surrounding skin* ■ Wound progression/deterioration
Wound symptoms	■ Presence of wound pain* ■ Type of pain ■ Pain frequency* ■ Pain severity* ■ Itch ■ Exudate amount* ■ Exudate type* ■ Current exudate status (increase/decrease) ■ Impact of exudate on patient ■ Presence of odour* ■ Odour intensity/status/impact to patient ■ Signs of local infection* ■ Signs of spreading infection ■ Signs of systemic infection* ■ Management of infection ■ Infection diagnosis, such as biopsy or wound swab taken*
Specialist information	■ Wound care team and hospital consultant referrals* ■ Investigation for lower limb (ABPI or TBI)*
Additional considerations	■ Date of wound assessment ■ Changes in wound surface area ■ Local infection indicators ■ Was a wound swab required based on clinical assessment? If so, date wound swab taken and sent for analysis? ■ Wound swab results? ■ Wound moisture level?
*Maintained in the final minimum data set[10] ABPI: ankle–brachial pressure index; TBI: toe–brachial index	

APPENDIX C

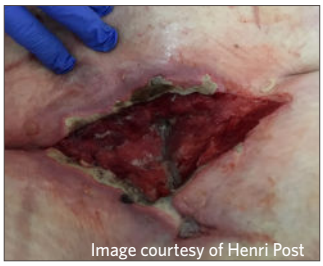
Library of wound photographs.

This appendix provides visual examples of healing wounds and wounds that are impaired by common barriers indicated by the TIME concept. Photographs have been provided by the expert working group, and can be used for clinical education in wound care when referenced accordingly:

e.g. Image courtesy of Dot Weir. World Union of Wound Healing Societies (2020) *Strategies to reduce practice variation in wound assessment and management: The T.I.M.E. Clinical Decision Support Tool.* Wounds International, London. Available at: www.woundsinternational.com

Type of Tissue seen in the wound bed

Healthy granulation tissue



Dark, unhealthy granulation tissue

Slough requiring debridement

Slough requiring debridement

Dry slough

Friable granulation tissue

Exposed tendon

Necrotic tissue

Dead epidermis

*Jacqui Fletcher, Independent Nurse Consultant (UK).

Inflammation and Infection

Infection

Infection and necrotic tissue

Inflammation of skin surrounding wound

Infection, necrotic tissue and exposed tendon

Infection and slough

Deep infection and slough

Moisture

Dry wound bed

Moist wound bed

Macerated wound

Wound Edge

Epithelialisation

Epithelial migration

Raised wound edge

Dry wound edge

Dry wound edge

Violaceous wound edge with pyoderma

Poor wound edge and surrounding skin

Rolled wound edges

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