

A clinical audit of a TVS using applied wound management

Within the UK there are little data available to determine wound healing and prevalence rates. Applied Wound Management (AWM) software has been developed to provide a system of wound assessment and data collection that enables clinicians to review and audit their practice, but also to combine it with other clinician's findings to produce comparative, quantifiable data. This article presents wound-related data gathered from a Department of Tissue Viability operating within an Acute setting. The findings provide an overview of the service provided, and further analysis of one sub-group identifies how clinical outcomes can be tracked using the AWM software.

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KEY WORDS

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Data Analysis
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Wound management is a constantly evolving speciality with frequent developments in both knowledge and products. In an effort to reduce possible confusion, attempts have been made to categorise or grade different wounds using a systematic approach (e.g. Wound Bed Preparation). However, such attempts have failed to cover inter-operator variations in assessment and treatment that may arise when dealing with wounds healing by secondary intention (Gray et al, 2004).

Some of the systems have focused on the colour of the tissue present

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within the wound, identifying that black and yellow wounds should be debrided, and that red and pink wounds should be encouraged to heal by promoting an environment that facilitates granulation and epithelialisation (Cuzzell, 1988; Stotts, 1990; Krasner, 1995; Lorentzen et al, 1999).

This simple colour coding of wound beds, and the accompanying suggestion of treatment aims may be 'an over simplification' (White, 2003), when the added complications of wound infection and exudate management are considered. For example, a wound may be yellow and sloughy due to the presence of infection and therefore the immediate focus should be on the treatment of the infection (Gray et al, 2004) not on debridement as the system may imply. It has also been observed that the so called red, healthy wound may actually be critically colonised and have a level of bacteria present which inhibits healing. These factors should be addressed when considering treatment options (White et al, 2002; Gray et al, 2005a).

Applied Wound Management

Applied Wound Management (AWM) has developed and refined the earlier simplistic attempts to identify the tissues in a wound through colour. It focuses upon which colour represents the major clinical challenge in the wound, while also considering infection and exudate status.

AWM and its three continuums were developed initially to provide the clinician with a standard framework to work within to ease the assessment of any wound and identify possible treatment options.

The continuums are:

- ▶▶ The Wound Healing Continuum (WHC)
- ▶▶ The Wound Infection Continuum (WIC)
- ▶▶ The Wound Exudate Continuum (WEC).

The Wound Healing Continuum

The WHC identifies the type of tissue present within the wound using a left to right progression, from black (left) through to pink (right). Identification of the tissue furthest to the left of the continuum will determine treatment objectives, i.e. in a black/yellow wound the colour of importance is black and the objective is to debride (Gray et al, 2005b). Wound progression to the right of the continuum indicates improvement, while deterioration of the wound can be noted by a shift to the left.

The Wound Infection Continuum

The WIC helps the clinician to assess the level of bacteria present in the wound (bioburden) and the host's response (Kingsley, 2001; Kingsley et al, 2005). It spans left to right with the most severe condition, spreading infection at the left, progressing to

infection, critical colonisation, and finally, colonisation on the right. Each term is defined below the continuum to help the clinician in their diagnosis:

- ▶ Spreading infection (cellulitis) is defined as a rapidly and continuously advancing redness in the absence of suitable systemic antibiotic therapy. The area of redness will be well beyond the immediate wound margins (described as approximately 2cm from the wound edge), is usually accompanied by increased pain, high exudate, increased heat and sometimes with odour, wound extension and blistering of surrounding tissue. Untreated, spreading infection can be life-threatening and action should be taken immediately.
- ▶ Local infection is described as an area of redness, and often increased pain, with an approximate 2cm margin of the wound. A red flare greater than 2cm may emanate from one of the wound edges but remains localised in character and does not rapidly increase, even in the absence of suitable antimicrobial therapy. Symptoms are similar to those found in spreading infection but are less severe.
- ▶ Critical colonisation is often used to describe a wound with few symptoms of infection, but that is showing signs of delayed healing (Cutting, 2003; Kingsley, 2003; Scanlon, 2005). These wounds are often wetter than normal, odorous and sloughy, and visible granulation tissue may have turned a dull, unhealthy red.
- ▶ Colonised wounds contain bacteria, which should be expected in any wound healing by secondary intention, but no visible host reaction. These wounds respond as predicted to appropriate standard treatment and are considered to be progressing towards healing in the expected timeframe, without antimicrobial therapy (Gray et al, 2005b).

If a wound is identified as having either a spreading infection, local infection or critical colonisation, it is

deemed appropriate that action must be taken to reduce the effects of bacteria (Kingsley et al, 2005).

The Wound Exudate Continuum

Wound exudate plays a significant part in the diagnosis and treatment of any wound and the WEC helps to determine not only the level of exudate present within the wound but also its viscosity. Why is this important? It has been recognised that the viscosity of the exudate can determine if the wound is infected or not (Vowden and Vowden, 2004). The WEC uses colour coding to produce a combined assessment of exudate levels and viscosity. Wounds with low exudate viscosity and volumes are coded green. High volumes and high viscosity are coded red which is a danger zone indicative of infection and a review of the patient's overall treatment should be undertaken. However, those wounds that fall in the amber zone are either moving from the red zone, showing an improvement or should be closely observed to ensure that they do not deteriorate and move into the red zone (White and Gray, 2005).

By using the three continuums simultaneously, the clinician can identify and record the colour of tissue present in the wound, the wound bioburden and infection status, and the requirement for exudate handling. The latter aspect can guide dressing selection or other measures required to manage exudate and give an educated assessment of probable wear time. The WHC and WIC can also be numerically scored to provide a combined total that can be used to monitor, by simple graphing, the progression of a wound into a position where healing is likely to take place.

Accurate diagnosis of the wound's pathology supported by the three continuums will place the practitioner in a position to identify treatment objectives and monitor the effects of the treatments by measuring the clinical outcomes against the initial assessment. This can be supported by AWM pocket guides, assessment and documentation

charts, wall charts and the software. See *Further Information* for details of how to obtain these aids and a detailed guide to the use of AWM.

Applied Wound Management software

The AWM software* was developed in order to provide an easy to use decision support resource for practitioners, and to enable the collation of audit data concerning wound management practice on a much larger scale than has been done before. This benefits the individual practitioner by allowing them to validate their clinical judgement against clinical outcomes from other practitioners and clinical centres, and benefits the wider wound care community by providing empirical data on the number and type of wounds treated, and the treatment regimens used, across different clinical settings.

The software is made up of two parts; a stand-alone application that runs on the practitioner's computer, and a central data repository hosted on secure web servers that receive anonymous audit data from practitioners. Additionally, the servers distribute updated lists of dressings and articles for the decision support knowledge base.

The software can be used to provide a number of reports for different scenarios. Patient reports can be used to record the patient reviews undertaken, from one single review in a clinic to multiple reviews if the patient presents with a wound(s) that requires regular reassessment and intervention. The reports generated can go with the patient when being transferred to other care providers, and act as a full detailed report of the assessment undertaken and treatment selected.

Clinician-based reports can also be generated. These allow the practitioner to record details of their workload between specific dates or generate reports for individual patients for inclusion in their clinical notes.

*The Applied Wound Management Software Package was developed by Dalmore Information Services and Wounds UK and is sponsored by Johnson and Johnson Advanced Wound Management UK.

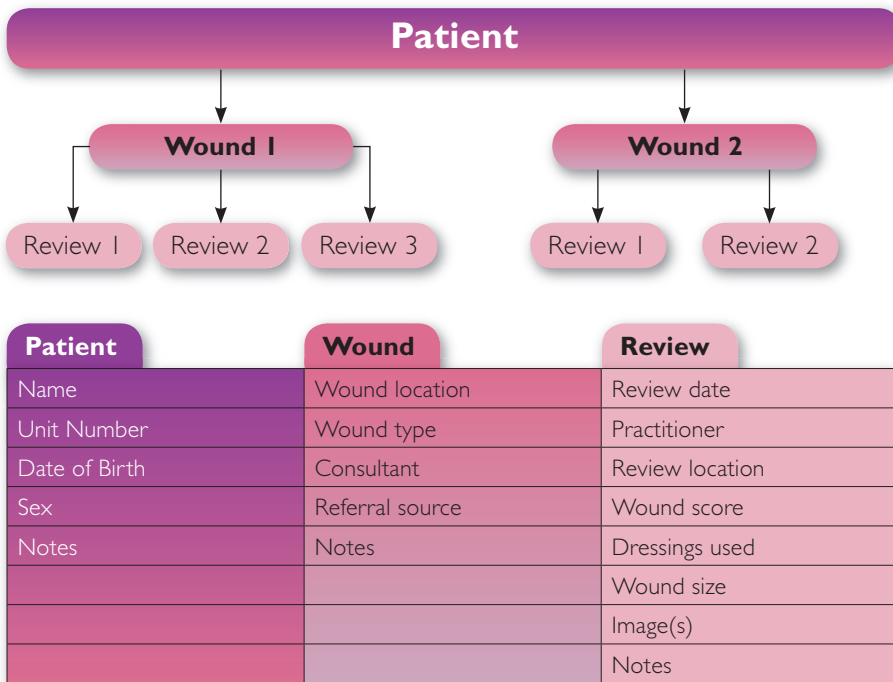


Figure 1. Data model.

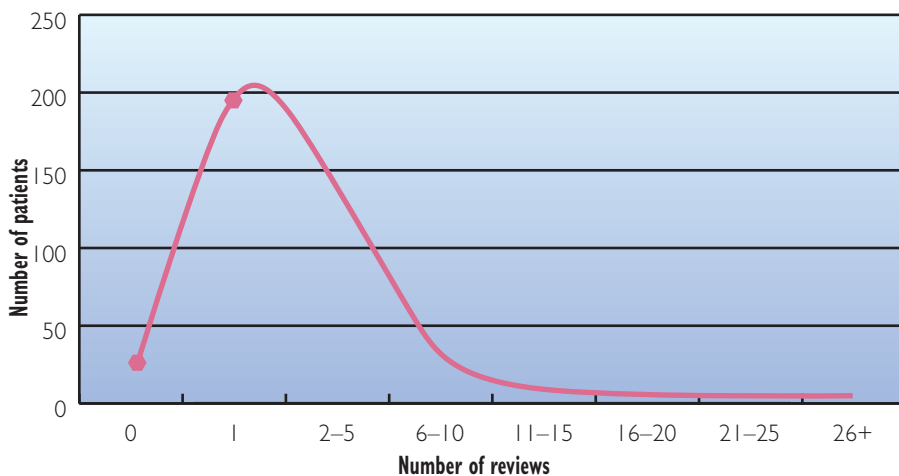


Figure 2. Number of times each patient was reviewed (n=242).

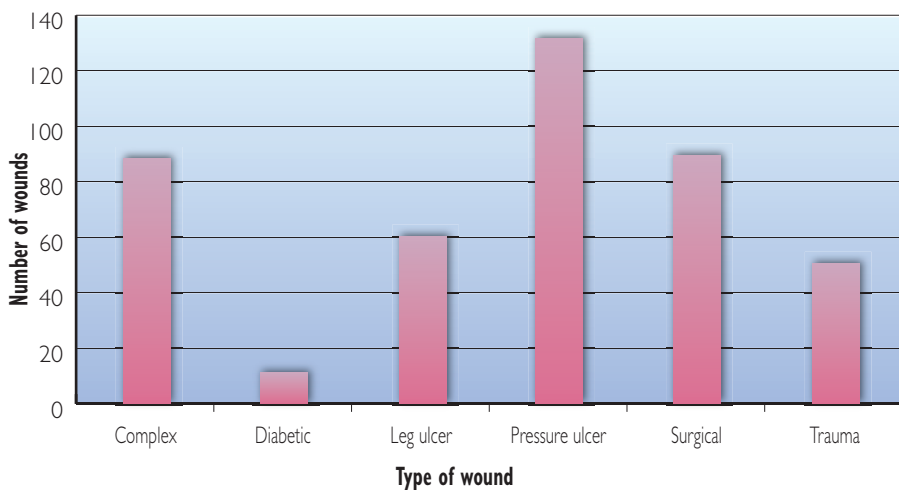


Figure 3. Wounds identified by type.

Furthermore, the downloaded data on the central repository can be used to identify national trends in wound types and treatments. The data will identify the numbers of particular wound types reviewed. It is hoped differences in practice can be determined from this information. For example, it may show that patients presenting with heel pressure ulcers in an acute service will be reviewed an average of 2–3 times, whereas those in the primary care setting will be reviewed 6–7 times. Such a report could be used to support the development of standard care pathways in the management of these particular wound types, in an attempt to reduce the number of reviews made. Answers to questions such as 'how many wounds are currently being treated with an antimicrobial when according to assessment there is no indication of infection or critical colonisation?' can also be found using the AWM software.

The aim of collecting and analysing data using the AWM software is to not only supply information regarding the types of wounds which present, but also to look at the differential diagnosis and treatment objectives, both locally and nationally.

This article will now focus upon the use of the AWM software and its use in a Tissue Viability Service in an Acute NHS Setting.

AWM software in practice

The department of tissue viability located within Aberdeen Royal Infirmary provides a clinical service to the infirmary, two hospitals and a hospice, totalling approximately 2000 beds. The department is staffed by four nurse specialists and one senior research fellow. Referrals are made to the department by nursing and medical staff and patients are reviewed in their own wards.

Aim

The AWM software was used to gather data that could provide an analysis of the service provided by the Tissue Viability Department at Grampian Health Authority.

Method

Over a 5-month period, referrals made to the tissue viability service were recorded using the AWM Software package.

The AWM software uses a simple data-collecting model based around patients, wounds, and reviews. Each patient can have one or more wounds and each wound can have one or more reviews, as illustrated in Figure 1.

Once a patient record has been entered into the system, any number of wounds can be added for that patient without having to re-enter the patient details. Similarly, once a wound record has been entered, any number of reviews of that wound can be added.

After each patient review, data was added to the software by the individual practitioner into their own stand alone computer. At the end of the trial period, the data was uploaded to a central repository which automatically anonymised the data collected and allowed analysis of the data as a whole.

Results

Population

During the 5-month study period, 403 patients were reviewed (Female, n=242, 60%; Male, n=161, 40%; Age range=1–107 years). Figure 2 presents the number of times each patient was reviewed. Notably, 197 [48.9%] patients were reviewed once and then discharged, with a further 138 [34.2%] reviewed 2–5 times before discharge from the service.

Wound types

Figure 3 presents the wounds as identified by type. Ninety patients [20.88%] were described as having a complex wound. Wounds such as fungating lesions, vasculitic lesions, and wounds resulting from systemic shock are some of those categorised as Complex. Ten [2.32%] patients were found to have a diabetic wound, and 60 [13.92%] patients had leg ulcers. Pressure ulcers were the largest wound type (n = 131; 30.39%), and 90 [20.88%] patients were classified

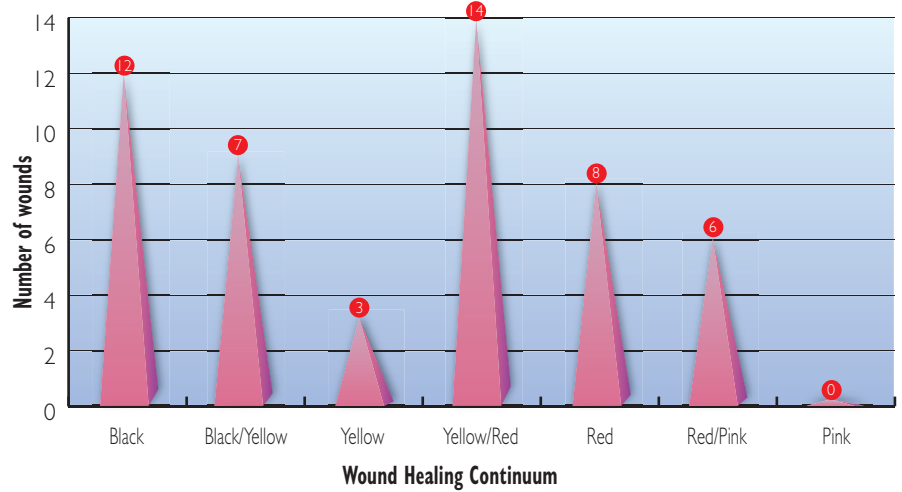


Figure 4. Results of the Wound Healing Continuum assessments carried out at first review for patients with heel pressure ulcers.

Table 1.

Wound Infection and Exudate Continuums (pressure ulcer-heel)

	Red	Amber	Green
Spreading	0	0	0
Local	0	1	3
Critically colonised	0	1	6
Colonised	0	0	39

as having a surgical wound. Finally, 50 patients [11.60%] were found to have a wound resulting from trauma.

Wound locations

The AWM software enabled the location of every wound to be recorded. Complex wounds were recorded on 18 different locations of the body, while diabetic wounds were located on either the leg, malleolus, foot or toe. Of the 60 leg ulcers, 58 were located on the leg with two identified as extending on to the foot. Of the 131 pressure ulcers, 125 were located below the waist with the majority on either the sacrum, buttock or hip (n=67[53.6%]). The other main area of pressure ulceration below the waist was on the heel with a total of 50 [40.8%] patients having this wound type. Of the 90 surgical wounds, the majority were located on the abdomen (n=56[62.2%]), with the remainder of the wounds

across a further 10 locations. The trauma wounds were spread across 14 different locations with the largest number on one location being the leg with 15 [30%].

Heel pressure ulcers

Heel pressure ulcers accounted for 50 [40.8%] of the 131 pressure ulcers recorded, and were the largest single anatomical location within Pressure ulcers, the largest wound type.

Figure 4 presents the results of the WHC assessments carried out at the first review of the heel pressure ulcers. Of the wounds, 22 [44%] were classified as black, black/yellow, and yellow, thus indicating the need for debridement if clinically appropriate. Fourteen [28%] wounds were described as being yellow/red, suggesting a joint objective of debridement and promoting granulation, and 14 [28%] as red and

Table 2.
Number of days of treatment and reduction in surface area of wound

Patient number	Days of treatment	Cm ² reduction in wound size
1	42	8
2	14	2
3	12	29
4	105	105
5	71	18
6	20	10
7	14	3.8
8	7	5
9	15	3
10	20	36
11	31	7
12	16	2.25
13	81	14
14	90	14
15	84	33
16	7	4
17	110	7
18	230	21
19	18	0.75

red/pink indicating granulation and re-epithelialisation as likely healing outcomes.

Table 1 presents the results of the WIC and WECs. It is clear that the majority of heel ulcers reviewed were colonised (n=39; [78%]), with seven [14%] critically colonised, four [8%] locally infected and none with spreading infection. Table 1 also identifies that the majority of the wounds 48 [96%] were categorised in the green zone of the WEC and the remaining two patients in the amber zone.

Table 2 shows the relationship between treatment received (in days) and the reduction in surface area of the wound. Of the 25 patients with heel ulcers who were reviewed more than once, four had no measurements recorded, one remained static, one

enlarged, and 19 reduced in size. The mean number of days of treatment was 51.9 days (range = 7–230 days] and the mean surface area reduction was 16.98cm² (range = 0.75–105cm²).

Figure 5 shows the number of days taken for a wound to progress from needing debridement (as indicated by a black, black/yellow, yellow, yellow/red WHC result) to debridement completion (as indicated by movement into the red area of the WHC). Of the 13 patients whose wounds were debrided, the mean number of days until completion was 24.3 days (range = 7–47 days) and in 11 of these patients, the surface area of the wounds were recorded, with a mean reduction in surface area of 9.0cm² (range = 0cm–30cm). However, two wounds in this group did not reduce in surface area while debridement took place.

During the period of heel ulcer treatment, 12 patients were assessed as being either locally infected (n=6) or critically colonised (n=6) using the WIC. In the locally infected group, each patient was commenced on a topical antimicrobial. The mean number of days of treatment required before the wound returned to a colonised state was 14 days (Range = 7–38 days). In the critically colonised group, the mean number of days of topical antimicrobial required to return the wound bed to a colonised state was 10.3 days (range = 6–14 days).

Discussion

The data collected using the AWM software has provided an unprecedented insight into the work of a tissue viability service operating within the NHS. By utilising this software it has been possible to define the population served by the service and the types of wounds referred. This information can allow for the planning of education and integrated care pathways targeted at frequently referred wound types thus providing support to ward staff.

It is clear from the pattern of reviews presented in Figure 2 that a large proportion of referrals are discharged from the TVS after one review, once a plan of care has been established, as would be expected for an acute specialist service. In the next largest group of patients (n=138; [34.2%]) are those who are reviewed between 2–5 times before discharge thus allowing the evaluation of the treatment in more challenging cases.

A high number of pressure ulcers and surgical wounds were referred to the tissue viability service (Figure 3) reflecting the acute nature of the Trust. This is also reflected in the low number of diabetic wounds encountered, since these are usually treated in specialist diabetic foot clinics. The relatively high proportion of wound categorised as complex reflects the numbers of challenging wounds which are referred to the service.

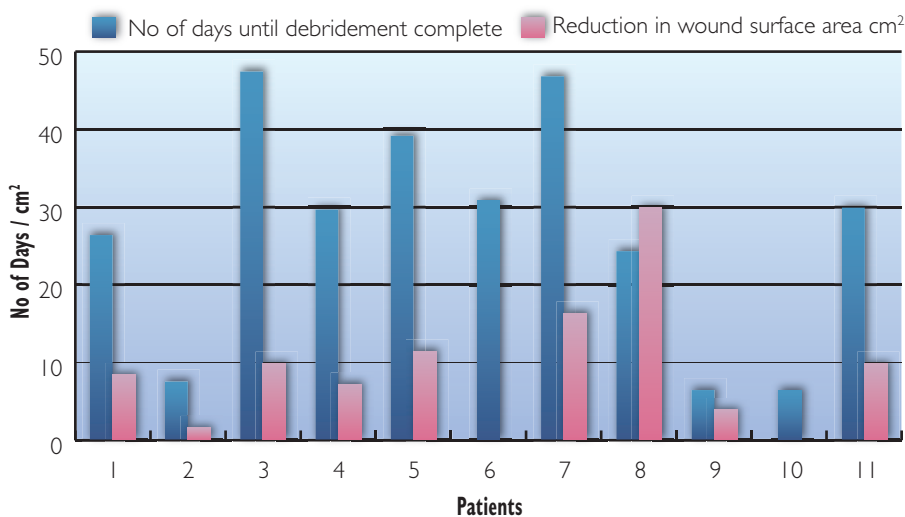


Figure 5. Number of days to debridement.

Pressure ulcers were the largest wound type encountered by the service, with those of the heel being most frequently documented.

On referral, the majority ($n=36$ [72%]) of the heel pressure ulcers required some form of debridement based upon their assessment using the WHC. Debridement is only recommended by the department when it is felt that the patient has sufficient vascular supply to the area and that debridement is in the best interests of the patient. In *Figure 5* it is clear that there is wide variation in the time required to achieve debridement and this is an area which requires further investigation. Having now established a baseline, it will be possible to evaluate new methods of faster debridement.

Another important finding from the analysis (*Figure 5*) was that while debridement was being achieved, so the surface area of the wounds reduced. This serves as a reminder that while using the WHC, attention must be paid to the size of the wound because while the colour assessment using the continuum may remain static, the actual size of the wound may reduce.

On referral, the levels of infection were found to be low as identified in *Table 1* and it is clear that the majority

of patients at first review were considered to have colonised wounds. However, it is interesting that in a small number of cases, there appears to be an inconsistency between the use of the WIC and WECs in relation to locally infected and critically colonised wounds. Some patients assessed as being in these categories were assessed to have exudate in the green zone indicating healthy exudate. This is an interesting finding and one which merits further investigation as it may relate to user error or specific clinical presentations which act as the exception to the rule.

During the treatment phase, 12 patients with heel ulcers were identified as having a locally infected ($n=6$) or critically colonised ($n=6$) wound bed, and all patients were commenced on topical antimicrobial therapy in an effort to alter the state of the tissue. In the locally infected group, the wound bed was returned to a healthy state after a mean of 14 days, with 10.3 days required to achieve the same result in the critically colonised group. It appears that through the timely application of effective topical antimicrobials, the wound beds were returned to a healthy state, but it should be noted that in one case this was only achieved after 38 days. These findings are supportive of the use of topical antimicrobials and appear to indicate

that the short-term use of these products is sufficient to bring about a positive change in the wound bed.

It is evident from the data that the majority of wounds were colonised with relatively few being critically colonised, or having local or spreading infection. This would indicate that antimicrobials would not be routinely indicated as a first-line treatment option.

By analysing the findings in this subgroup, it was possible to demonstrate the type of data that can be generated using the AWM software. With data from sub groups such as 56 abdominal wounds, 50 large complex leg ulcers and 46 sacral pressure ulcers still unanalysed, there is huge scope to provide further healing times and influence practice development.

Conclusion

In this paper, the authors have provided an insight into the data collected over a 5-month period using the AWM software in an acute hospital setting. By presenting an overview of the data set as a whole and focusing on the analysis of the patients with pressure ulcers to the heel, the authors have demonstrated the type of information which can be obtained through the use of the AWM software. The authors will continue to interrogate the data acquired to date. Further data collection will take place within the Department of Tissue Viability in Aberdeen and in partnership with colleagues across the UK. It is hoped that this will allow widespread analysis that will help inform the future of practice and service development, while also confirming the positive impact an integrated Tissue Viability Service can have on the NHS in the UK. **WUK**

Further information

As the AWM software is free and requires a small amount of time to complete for each patient, there seems considerable scope for the generation of similar data across different clinical settings in the UK.

The Wounds UK website has an AWM section where downloads of all articles supporting AWM, wall charts, pocket guides and assessment forms are available for free. Further information on the AWM software package is also available. www.wounds-uk.com