A formal senior review process of data from a wound management digital system to identify wounds that may be on a deteriorating trajectory: a review

KEY WORDS

- ehealth
- Senior review
- Telehealth
- Wound management
- Wound management digital system

ABSTRACT: This service evaluation demonstrates how data from a digital wound management system could be used to improve healing rate trajectories for people with deteriorating wounds. Data entered by clinicians at the point of care was used to identify people who may have a deteriorating wound, enabling senior clinicians to provide a remote treatment plan without undertaking a face-to-face visit. This report provides a service-evaluation data from a Wound Management Digital System (WMDS) used to determine if wounds were improving or not. A formal 'senior review' process in the Podiatry Service was evaluated. We identified that 56% of people saw a reduction in their wound area following the review. This was compared with wounds that had been identified as deteriorating by the WMDS, but not formally reviewed, where 50% of wounds improved. This paper provides some early evidence on the effectiveness of a Senior Review process based on data output from a WMDS.

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Livewell Southwest provides integrated health and social care services across Plymouth, South Hams, and West Devon, to a population of approximately 330,000 people. Within this population, the expected incidence of people with chronic wounds would be around 10,000 (Guest et al, 2020), many of whom will present to the organisation's Podiatry, Lower Limb, Tissue Viability, or District Nursing Services. With the expected 71% increase in wound prevalence (Guest et al, 2020), coupled with a rising population, this number is likely to rise, placing an increased burden on these services.

The organisation adopted the use of a wound management digital system (WMDS) in Spring 2020. Clinicians have a secure smartphone app, which is used to obtain a 3D scan of a wound. The software then calculates the wound dimensions and area, estimates the tissue composition of the wound bed, and allows the clinician to record a structured wound assessment. Every individual piece of data from each assessment is reportable directly from the WMDS into a spreadsheet, enabling further analysis of the data to take place at a caseload level.

Scans are completed at a rate of approximately 800–1000 per week, yielding over 80,000 individual scans of over 11,000 individual wounds. The adoption journey is described in an editorial by one of the authors of this paper (Oliver, 2022).

Digital Wound Management (DWM) is not just about the images obtained by clinicians. There is additional and significant data that, if recorded by clinicians during assessments in a consistent manner, can be used to monitor large populations of people with wounds under the care of an organisation, and identify those on a negative trajectory.

This report provides a service-evaluation of data from the WMDS, used to identify people with wounds who may be heading onto a negative trajectory, and how a formal remote review of the wound and care plan affected the healing trajectories of the wounds identified.

Table 1. Difference between Inter and Intra-rater reliability	
Intra-rater reliability	**Inter-rater reliability**
The consistency of an individual in measuring the same phenomenon (e.g. the reliability of a single clinician in the measurement of the same wound dimension)	The consistency of different individuals in measuring the same phenomenon (e.g. the reliability of multiple clinicians in the measurement of the same wound dimension)

Wound area estimation

Khoo et al (2016) assert that the accurate measurement of wounds is an important aspect in determining the efficacy of ongoing wound management and the continued analysis of wound dimension can help predict wound healing.

In the absence of a WMDS, wounds are typically measured using a paper ruler. Estimates of the wound area are obtained by multiplying the length and width of the longest edges of the wound. Given that wounds are rarely of a standard geometric shape, this can lead to the over-estimation of wound size by 10–40% (Khoo et al, 2016). This error can be compounded by errors in measurement associated with intra and inter-rater reliability (Table 1; Rogers et al, 2010)

Haghpanah et al (2006) stated that the reliability of repeated wound measurement techniques can only be achieved with the same observer. Practically, it is very challenging to ensure that people with wounds have continuity of wound care from the same clinician each time. The NHS Workforce Plan (NHS England, 2023) highlights that the NHS has 154,000 fewer full-time posts than is required, and the effects are felt locally. The result of this is that various clinicians will typically be involved in the care of an individual with a wound.

Automated wound area calculations from the WMDS have enabled wound areas to be calculated with a high degree of consistency, accuracy and reliability that is not prone to intra/inter observer error.

Wound data in electronic patient records

In our experience, obtaining insights into the delivery of wound care from data held within electronic patient records is challenging. The inconsistency of data recording between clinicians and teams makes it very difficult to obtain accurate and reliable data sets that can be used for any form of analysis.

The consistent recording of data within the WMDS has enabled the processing of data recorded by clinicians into usable clinical information. The large number of wounds recorded on a weekly basis enabled the identification of people with a wound who may not be on a healing trajectory.

Development of the 'senior review'

A 'senior review' in this context is defined as a group of clinicians of two or more coming together to remotely review the care received by a patient, with the view to make changes to the care plan where necessary. This may include the changing of dressing regimens or the expediting of referrals. The reviews are formally recorded in the electronic record of the patient.

The 'senior reviews' were established within two services: the Lower Limb and Podiatry Services. The data from this report was made available to other services within the organisation, but the process of formal review was not adopted within these services due to a range of factors, including severe service pressures.

The senior review meetings were conducted for people who had been identified using data from the WMDS who may be on a deteriorating trajectory. Table 2 shows the criteria that was used to identify people for the review on a weekly basis:

Evolution of the senior review

The senior review process has been continually improved and adjusted to fit service needs and to aid data analysis. These changes have included the way that patients are flagged from the outlier report to review and how the review is documented.

It was identified that the use of data could not be used in isolation. Where healing was not a realistic outcome for patients, for example those that were close to end of life or had fungating wounds, these patients were flagged on a regular basis. Further development work is required to determine how these individuals can be identified through data.

Evaluation of the effect senior review on wound areas

Anecdotal evidence from the clinicians undertaking

Figure 1. Proportion of improved and deteriorated wounds following the senior review in Podiatry. Split of improved/ deteriorated wounds as indicated by recorded wound area

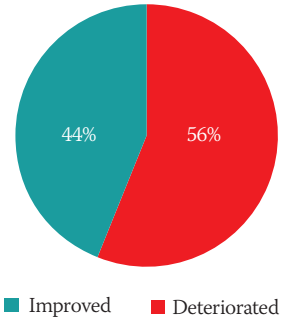


Figure 2. Proportion of improving/ deteriorating wounds in services where a senior review had not taken place, but the wound had been identified as potentially deteriorating

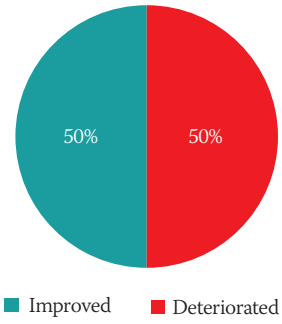


Table 2. Criteria used to identify potentially deteriorating wounds in this evaluation

Variable	Rationale	How obtained
Wound area increasing on average by 10% per week over a 3 week or longer period	An increasing wound size is a clear indicator that the wound is deteriorating (Khoo et al, 2016)	Automatically calculated output from digital system
A new infection has been diagnosed clinically by a clinician	Bacterial infection is associated with delayed healing times (International Consensus Document, 2008)	Y/N response to question in WMDS- 'Are there clinical signs of infection present?'
Visual analogue pain score ≥7	Pain is associated with reduced quality of life for people with wounds (Newbern et al, 2018)	0-10 scale self-reported by the person with the wound

Table 3. Number of potentially deteriorating wounds identified

Service	Number of potentially deteriorating wounds identified
Podiatry	127
Lower limb service	291
All other services	894

the senior review meetings suggested that these were having a positive impact on both the patients and service delivery through care plan optimisation and efficient caseload management. The purpose of this evaluation was to determine if this effect could be quantified. Clinicians continued to record their assessments using the WMDS and this enabled the subsequent analysis of the reviewed wounds.

For this evaluation, patients under the care of the Podiatry Service were reviewed and compared against other patients who had been identified as meeting the criteria in Table 2 but had not received a 'senior review'. To be included in the evaluation, the wound needed to:

- Have been identified on the weekly report to clinicians
- Have had a completed assessment of the wound using the WMDS at least three times after being identified on the weekly report.

The area of the wound calculated by the WMDS was used to determine if the wound was improving or deteriorating. A smaller wound area was used to indicate that the wound was on a healing trajectory, and a larger area indicated a deteriorating trajectory. The most recent wound area was used to compare against the wound area recorded during the assessment immediately before the senior review.

Table 3 shows the number of people with wounds identified as potentially deteriorating using the data from the WMDS. The area of the wound had been recorded before and after its initial identification.

Formal senior reviews of wounds did not start immediately following the production of the report. This evaluation found evidence of 34 formal senior reviews taking place within the Podiatry Service where the area of the wound had been reassessed at least 3 times following the senior review.

Figure 1 shows the proportions of wounds that improved or deteriorated in terms of wound area following the senior review in Podiatry (56% improved). These were compared against those who had not had a formal senior review depite being identified as having a potentially deteriorating wound (50% improved; Figure 2), these people had continued to receive care and had assessments recorded using the WMDS.

Of the wounds within the Podiatry Service that had improved, the average reduction in wound size was 3.82cm^2, with these wounds reducing in size by 48% on average (range 4–99%). The wounds that increased in size increased by 2.66cm^2 (86%; Figure 3).

Caution should be taken when expressing changes in wound area as a percentage. If a wound starts very small and deteriorates, the percentage increase will also be very large, and the converse applies (Box 1). Vickers (2001) suggests that percentage change should not be used in statistical analysis as it does not correct any imbalance between groups at the baseline. Some of the wounds included in this evaluation were large at

baseline, whereas others were very small. Therefore, the actual change in wound size was evaluated in this case.

Potential benefits of the process

This evaluation has identified that where a formal senior review takes place, 56% of people saw a reduction in their wound area, whereas where it did not take place, only 50% of wounds reduced in area. This suggest that the individual skill and expertise of the clinicians will contribute to the improvement of the wound, but this proportion is increased by 6% with the senior review.

Since the deployment of the WMDS, approximately 120 wounds per week have been identified as potentially deteriorating, which is approximately 6240 wounds per annum. This evaluation did not follow the wound to the point of healing, so it is not possible to quantify the overall reduction in healing time.

If the results seen in this evaluation were achieved for every wound identified, the following effect might be seen:

Using the data derived from Guest et al's (2020) Burden of Wound care paper, it can be estimated that reducing healing time by one week can save approximately £90 in terms of staff and resourcing cost.

If all 312 patients shown in the example above had their wound healing time improved by two weeks, then this equates to £56,160 of efficiency savings. This does not represent a cashable benefit but will support making limited resources go further.

Box 1. Example of how wound size affects percentage change

- Patient X: Wound area before review is 0.58cm^2 on average and wound area after 1.94cm, therefore the percentage increase = 234%
- Patient Y: Wound area before review 17.15cm^2 on average and wound area after 27.68cm^2, therefore the percentage increase = 61%
- It is likely in this scenario that the change in wound size for patient Y is more clinically significant, in spite of the smaller percentage change

Examples of outcomes

During a senior review, multiple clinicians accessed various systems in parallel and completed a systematic review of the patient care plan. This collaborative approach allowed an in-depth holistic view of the patient records that is time effective and more detailed than usual routine independent assessment.

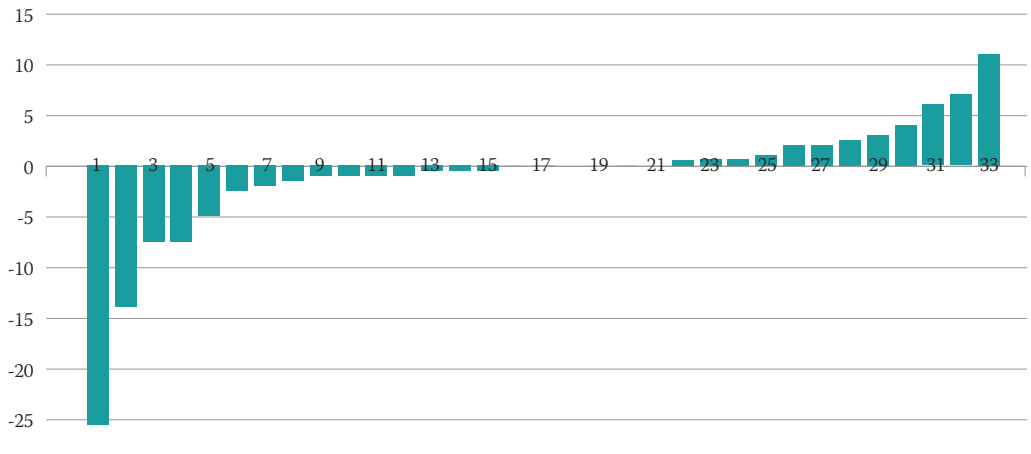
Examples of specific outcomes from the review have included:

- Improved antimicrobial stewardship
- Recognition of differential diagnosis
- Expediting of referrals to services such as Vascular and Dermatology
- Changes to management plans, for example dressing regimens
- Provision of equipment.

Staff value

Feedback from staff involved with the senior

Figure 3. Change the wound area for each reviewed patient



reviews state that they appreciated the collaborative discussion and felt supported in decision making:

> *'...productive thing for us to review these patients and make further plans to their care. It's going to give us all a better idea of what we can be looking to implement on other patients that are stagnating or deteriorating' (Senior Podiatrist)*

The senior review process has also highlighted some common themes where staff would benefit from further training or education. For example, it was identified that a service had varying levels of competency regarding the management of palliative patients. This has resulted in links with our organisation's palliative care leads, and additional training for the team, which has increased confidence in this area.

Limitation

The methodology used within this evaluation means that the results need to be viewed with caution. The sample of reviewed patients within Podiatry is very small compared to the overall number of people identified as potentially deteriorating. Additionally, the outcomes have been evaluated based on wound area. The wound area was not the only trigger for the Senior Review. Pain and the presence of clinical signs of infection also triggered it. The evaluation only used the area of the wound to determine the effectiveness of the review. It is therefore possible that some of the painful and clinically infected wounds were already on a healing trajectory at the point of the review.

The senior reviews did follow a template, but the actual review process was not standardised. This was due to the fact this was a new and evolving process. The purpose of the evaluation was to determine if there was any potential merit in reviewing wounds in this manner.

This evaluation suggests that the senior review process has tangible benefit for both people with wounds and for service delivery. It is recommended that the outcomes of this process are reviewed over a longer period of time and the evaluation is subject to greater controls, for example ensuring that the characteristics of the wounds reviewed are comparable between the groups where a senior review takes place and where it does not.

Recommendations for practice

- Senior reviews should be implemented by organisations with a WMDS as this process has been demonstrated to improve outcomes for people with deteriorating wounds
- Deployment of a WMDS needs to be done at scale to achieve benefits at organisational level
- Data from WMDS should be used to identify those on a deteriorating trajectory, prompting review by senior clinicians with the aim of putting the patient back on a healing trajectory
- Automating the processing of the data recorded by clinicians can make it available at the point of need
- Further exploration of the association between the observations recorded by clinicians using a WMDS is required to understand the strength of association between them, and those that are more likely to indicate that a patient is not on a healing trajectory. WUK

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