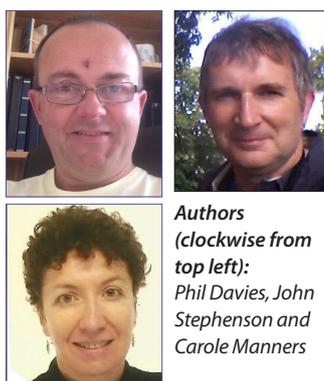


# Understanding undisturbed wound healing in clinical practice — a global survey of healthcare professionals



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This article presents data from a global survey that explored wound care professionals' understanding of the concepts of 'undisturbed wound healing' and 'dressing wear time' and evaluated whether this understanding is related to respondents' geographic location, profession or speciality. The type of wounds treated, typical and maximum length of time that a dressing is worn, and dressing change frequency were also explored. Knowledge about the meaning behind the two concepts was inconsistent, suggesting that clinical practice and the provision of evidence-based wound healing principles vary significantly. Further investigation as to how knowledge of these concepts impacts clinical practice is warranted.

It is generally accepted that a moist environment provides the optimal setting for wound healing and new tissue formation (Wokalek and Ruh, 1991; Sharman, 2003). Wound care is costly (Ubbink et al, 2014) and selection of the most appropriate treatment option is not always straightforward, but necessarily involves maximising the patient's and wound's healing capacity without interrupting or traumatising the healing process. It is important to note that, in some cases, it may be necessary to 'disturb' wounds for inspection and management (e.g. debridement). 'Undisturbed wound healing' is a relatively new concept. It is now widely referred to in the clinical management of both acute and chronic wounds (Stephen-Haynes, 2015), though a recent focus group and survey of wound care providers suggested that the meaning of this phrase was perceived differently from clinician to clinician (unpublished data). In a recent literature review, Brindle (2019) explored the themes of undisturbed wound healing and proposed four key considerations that should guide its practical application and improve outcomes: the patient, the caregiver, care of the wound, and economics [Box 1]. In terms of selection of dressings, the healthcare professional (HCP) should take into account how the products will impact the wound, the patient and their caregiver's response to care, the provider's time and resource allocation and the total cost of care (Davis et al, 2015; Brindle, 2019).

### Survey rationale

HCPs' understanding of and engagement with the processes involved in undisturbed wound healing can directly influence the outcome of treatment. To date, there is little evidence of the understanding and views of HCPs with regard to undisturbed wound healing and various other terms, such as 'stay-on-ability' and 'extended-wear-time'. Following feedback from clinicians with regard to the use of Mepilex® Border Flex (Comfort) (Rook et al, 2019), the authors decided to conduct an online survey aimed at wound care professionals worldwide, to assess their understanding of these terms and how they applied these in their clinical practice. The authors hoped that the data might identify factors that are important in the delivery of undisturbed wound healing and that might inform the development of future wound management guidelines.

### Materials and methods

The survey and questions were designed by Mölnlycke Health Care (Gothenburg, Sweden) and were generated using the online platform Survey Monkey ([www.surveymonkey.com](http://www.surveymonkey.com)). Emails to raise awareness of the survey among wound care practitioners worldwide were sent out to all subscribers of *Wounds International* and *Wounds UK* journals by the publisher OmniaMed Communications (London, UK), a medical education company. An additional e-blast (large number of emails) was sent out to all subscribers

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### Box 1. Undisturbed wound healing: key considerations guiding the practical application of wound care (Brindle, 2019)

- **Patient acceptability and comfort:** selection of a dressing that is comfortable, does not cause pain while worn or changed, or cause anxiety and stress, and that has the possibility for extended wear time
- **Care of the wound:** selection of a dressing that is gentle on the wound bed, that does not damage or adhere to the fragile tissues or extra-cellular matrix, and that has effective anti-bacterial activity, where appropriate
- **Provision of caregiver confidence:** selection of a dressing that permits the caregiver to see that dressing change is based on clinical evaluation (and not dressing failure), which will help to build trust between the healthcare provider, the patient and the caregiver
- **Cost-effectiveness:** selection of a dressing that reduces the overall cost of care – though unit cost may be more expensive – through high clinical performance, avoiding unnecessary dressing changes or ability to conform to difficult locations, such as the heel

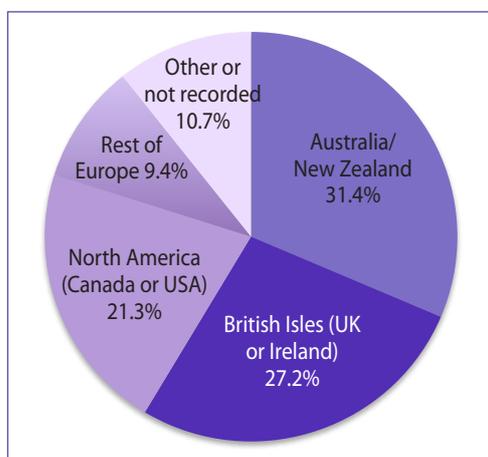


Figure 1. Geographic distribution of respondents (n=1,673).

of HMP Communications (Malvern, PA 19355, USA), a healthcare communications and education company publishing medical journals across a range of medical specialties.

The 13-question survey went live on November 8, 2018 and data were collected up to and including January 18, 2019. Basically, respondents were requested to provide their profession, speciality, geographic location and practice environment(s). They were also asked to report the types of wound encountered, dressing change frequency and factors and challenges influencing it, and typical and maximum number of days that a dressing on a wound of a given type would be left in place. Separate information was elicited for non-infected and infected wounds. Responses to these items were summarised across all wound types for comparison across profession, geographic region and speciality. Respondents were also requested to report their understanding of the terms 'dressing wear time' and 'undisturbed wound healing'.

#### Statistical analysis

Low-frequency categories were combined for

Table 1. Descriptive characteristics of the survey respondents (n=1,673).

Variable*	Number (%)
<b>Geographic region:</b>	
Africa	23 (1.4%)
Asia/Oceania (not Australia/New Zealand)	106 (6.3%)
Australia/New Zealand	526 (31.4%)
British Isles (UK or Ireland)	455 (27.2%)
Europe (not UK or Ireland)	157 (9.4%)
North America (Canada or USA)	356 (21.3%)
South and Central America	36 (2.2%)
Not recorded	14 (0.8%)
<b>Profession:</b>	
Nurse/tissue viability nurse/wound, ostomy and continence nurse	1367 (81.7%)
Doctor	125 (7.5%)
Allied health practitioner	130 (7.8%)
Other	39 (2.3%)
Not recorded	6 (0.4%)
<b>Speciality:</b>	
General practice	159 (9.5%)
Home care	211 (12.6%)
Hospital medicine	91 (5.5%)
Podiatry	85 (5.1%)
Surgery	194 (11.5%)
Wound care	626 (37.4%)
Other	302 (18.1%)
Not recorded	5 (0.3%)
<b>Practice environment:*</b>	
Patients' home	478 (28.6%)
Community clinic	295 (17.6%)
GP surgery	194 (11.6%)
Nursing/residential care home	345 (20.6%)
Specialist wound care clinic	357 (21.3%)
Hospital outpatients' clinic	320 (19.1%)
Hospital ward/department	589 (35.2%)
Not recorded	2 (0.1%)
<b>Wound type treated:*</b>	
Burn – superficial/partial/second degree	589 (35.2%)
Burn – full-thickness/third degree	225 (13.4%)
Diabetic foot ulcer	900 (53.8%)
Arterial leg ulcer	791 (47.3%)
Venous leg ulcer	874 (52.2%)
Mixed leg ulcer	855 (51.1%)
Pressure ulcer – deep	813 (48.6%)
Pressure ulcer – superficial	923 (55.2%)
Surgical wound – closed	790 (47.2%)
Surgical wound – dehiscent	814 (48.7%)
Traumatic wound – skin tear	925 (55.3%)
Traumatic wound – other	724 (43.3%)
Moisture lesion	720 (43.0%)

\*Respondents could select more than one answer

Table 2. Summary of typical and maximum times dressings are left on non-infected and infected wounds (n=1,116 respondents).

Wound type	Mean typical wear time (days)		Mean maximum wear time (days)	
	Non-infected	Infected	Non-infected	Infected
Burn – second-degree	2.89	1.71	4.73	2.70
Burn – third-degree	2.29	1.58	3.71	2.47
Diabetic foot ulcer	2.78	1.79	4.40	2.78
Arterial leg ulcer	2.94	1.81	4.56	2.71
Venous leg ulcer	3.31	1.96	5.22	3.01
Mixed leg ulcer	3.07	1.91	4.87	2.91
Pressure ulcer – deep	2.21	1.64	3.60	2.54
Pressure ulcer – superficial	3.42	2.14	5.06	3.23
Surgical wound – closed	4.36	2.17	5.81	3.20
Surgical wound – dehisced	2.18	1.65	3.60	2.53
Skin tear	3.95	2.13	5.67	3.19
Traumatic wound	2.80	1.88	4.69	2.96
Moisture lesion	2.05	1.61	3.28	2.47

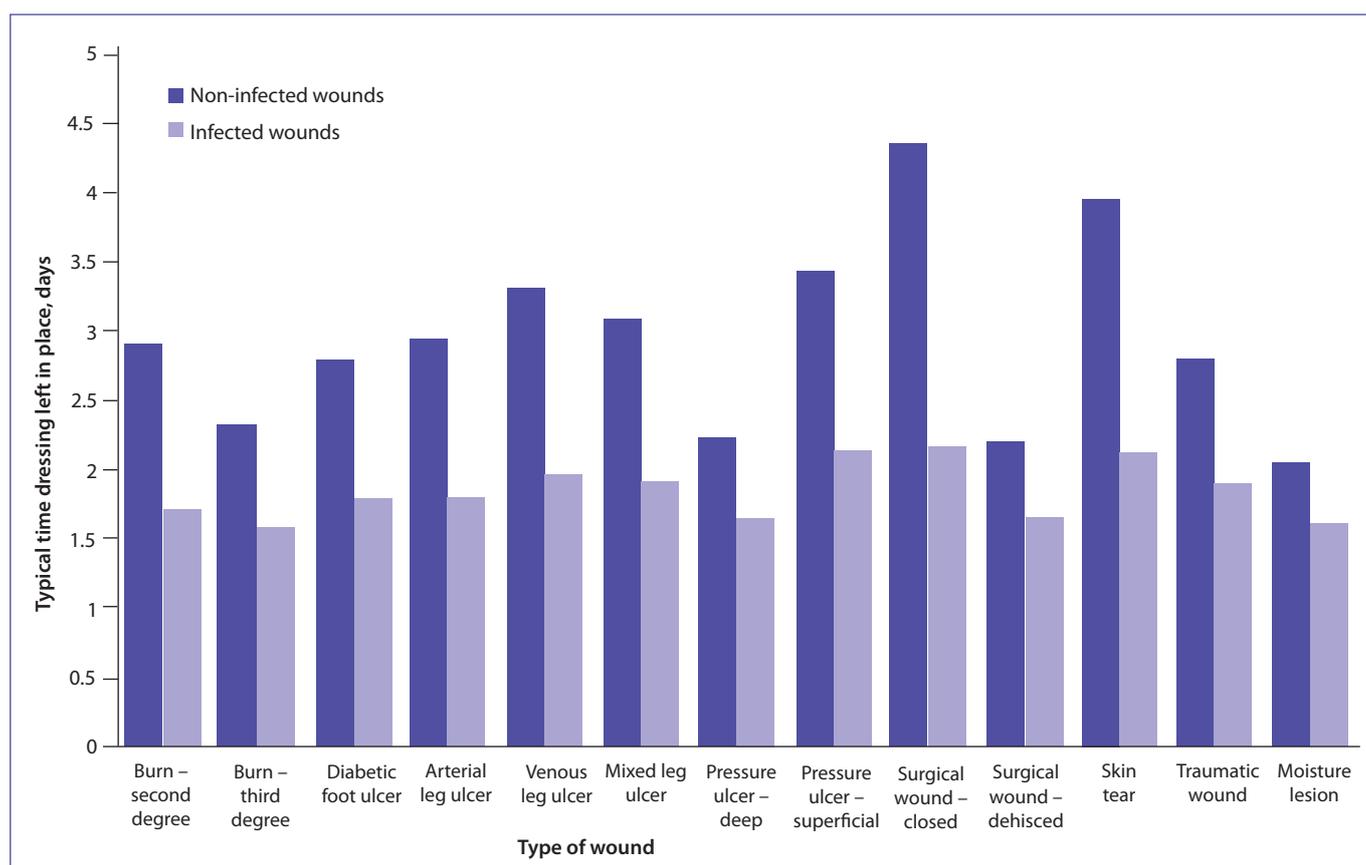


Figure 2. Typical number of days a dressing is left in place for various types of infected and non-infected wounds.

use in analyses of variance (ANOVA) to assess the significance of any differences in responses at different levels of the factors being studied. Association was assessed using a series of chi-squared tests conducted on the data, using knowledge level as the outcome. All geographic,

professional, speciality and practice factors were considered as predictors of knowledge level. Any factor indicating a substantive relationship with the outcome was carried forward into a multiple logistic regression analysis. Variables in this model showing no substantive relationship with the

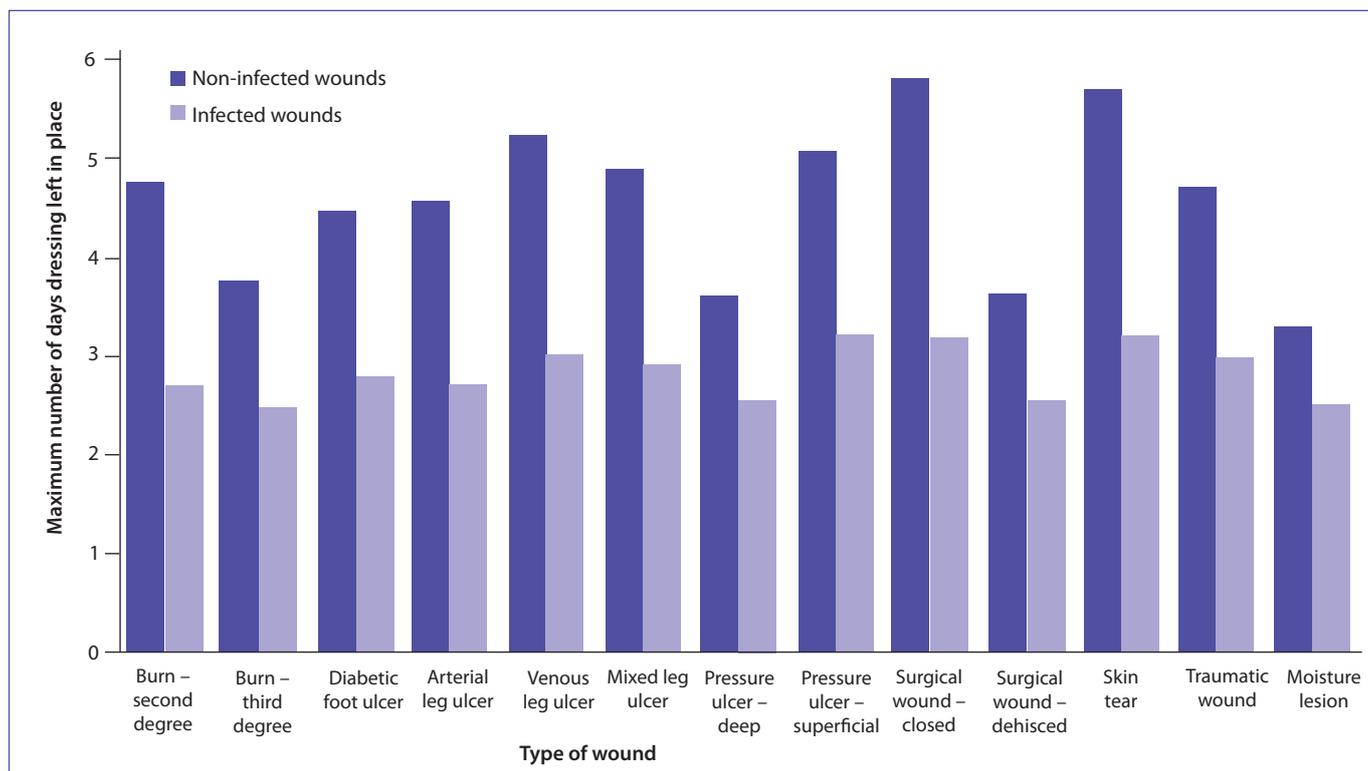


Figure 3. Maximum number of days a dressing is left in place for various types of infected and non-infected wounds.

Variable	Typical wear time (days)	F-ratio	Degrees of freedom	P-value
<b>Region:</b>		57.9	3,1073	<0.001
Australia/New Zealand	2.99 (1.06)			
British Isles/Europe	3.54 (1.51)			
North America	2.50 (1.18)			
Rest of the world	2.71 (1.21)			
<b>Profession:</b>		10.5	3,1071	<0.001
Allied health professional (n=130; 7.8%)	3.78 (1.76)			
Doctor (n=125; 7.5%)	2.73 (1.69)			
Nurse (n=1,367; 82.0%)	3.00 (1.23)			
Other (n=45; 2.7%)	3.17 (1.46)			
<b>Speciality:</b>		7.31	6,1069	<0.001
GP	3.16 (1.17)			
Home care	3.03 (1.16)			
Hospital medicine	2.49 (0.967)			
Podiatry	4.02 (1.92)			
Surgery	3.02 (1.57)			
Wound care	2.98 (1.21)			
Other	3.05 (1.39)			

outcome were removed in order to recast the final model as a parsimonious model.

## Results

### Descriptive summary

Data were collected from a maximum of 1,673 respondents. Data from all participants were included in the analysis, irrespective of how many questions they answered/didn't answer.

Most respondents came from Australia/New Zealand, the British Isles or North America [Table 1]; these three regions amounted to about 80% of all responses [Figure 1]. Of the respondents, just under 80% were nurses (including specialist nurses, such as tissue viability nurses, nurse educators, etc), with smaller numbers of doctors, including surgeons (7.4%), and allied health professionals (AHPs) (7.3%). The majority of AHPs who responded were podiatrists but physiotherapists and other health professionals, who come under AHPs also responded. Small numbers of other professions were represented including, for example and care assistants.

The most common specialities were wound care (35.9%) and home care (12.6%). Around 18% of all respondents did not choose any of the available options (summarised as Other in Table 1). Stated specialities among these respondents included a large number of low-frequency responses, such as community nurse,

Table 4. Typical wear times (mean plus standard deviation) and analysis of variance parameters in infected wounds by grouping variable.

Variable	Typical wear time (days)	F-ratio	Degrees of freedom	P-value
Region:		28.5	3,955	<0.001
Australia/New Zealand	1.77 (0.76)			
British Isles/Europe	2.28 (1.28)			
North America	1.51 (0.73)			
Rest of the world	2.10 (1.19)			
Profession:		14.4	3,953	<0.001
Allied health professional	2.61 (1.54)			
Doctor	1.68 (1.20)			
Nurse	1.88 (0.94)			
Other	2.40 (1.57)			
Speciality:		7.96	6,951	<0.001
GP	1.98 (0.88)			
Home care	1.97 (0.99)			
Hospital medicine	1.56 (0.68)			
Podiatry	2.79 (1.55)			
Surgery	1.76 (1.04)			
Wound care	1.87 (0.99)			
Other	1.97 (1.13)			

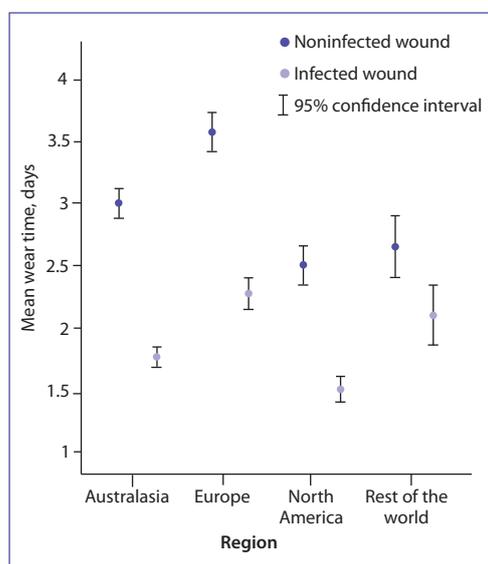


Figure 4. Typical wear times for non-infected and infected wounds by geographic area.

orthopaedic nurse, aged care, oncology, etc.

The most commonly given practice environment was a hospital ward or department (35.2%). Patients' homes was also commonly selected by participants (28.6%).

Respondents reported treating several wound types. The most commonly treated wound was superficial pressure ulcer, which 923 (55.2%)

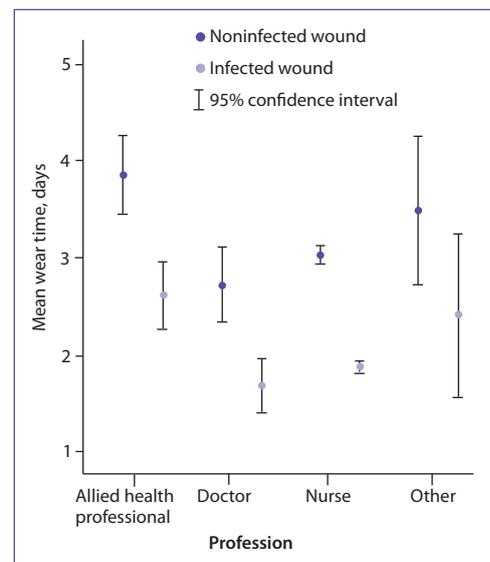


Figure 5. Typical wear times for non-infected and infected wounds by profession.

individuals selected. Many other wound types, including diabetic foot ulcer, venous leg ulcer, mixed leg ulcer and skin tear, were seen by around 50% of respondents. Full-thickness/third degree burns were treated by only 13.4% of respondents ( $n=225$ ).

### Typical and maximum lengths of time to change dressing

Change of dressing frequency was specified in around 40% of participants' wound care protocols and was sometimes specified in protocols used by about 28% of respondents. Other than the protocol, dressing change frequency was influenced, among others, by:

- Wound exudate (type and amount)
- Wound condition
- Wound odour
- Signs of infection
- Type of dressing.

The typical and maximum length of time (days) for which dressings would be left undisturbed by respondents treating different types of infected and uninfected wounds are summarised in [Table 2], [Figure 2] and [Figure 3]. Not surprisingly, dressings were usually left in place for shorter periods of time when a wound was infected [Table 2]; typically, dressing change was performed 1–2 days earlier for an infected wound than for the corresponding non-infected wound. Dressings used to cover non-infected, closed surgical wounds (4.3 days) and skin tears (3.95 days) were typically left in place for the longest periods of time. Dressings for moisture lesions (2.05 days) and deep pressure ulcers (2.21 days) were changed most frequently. There was less variation in the length of time dressings were

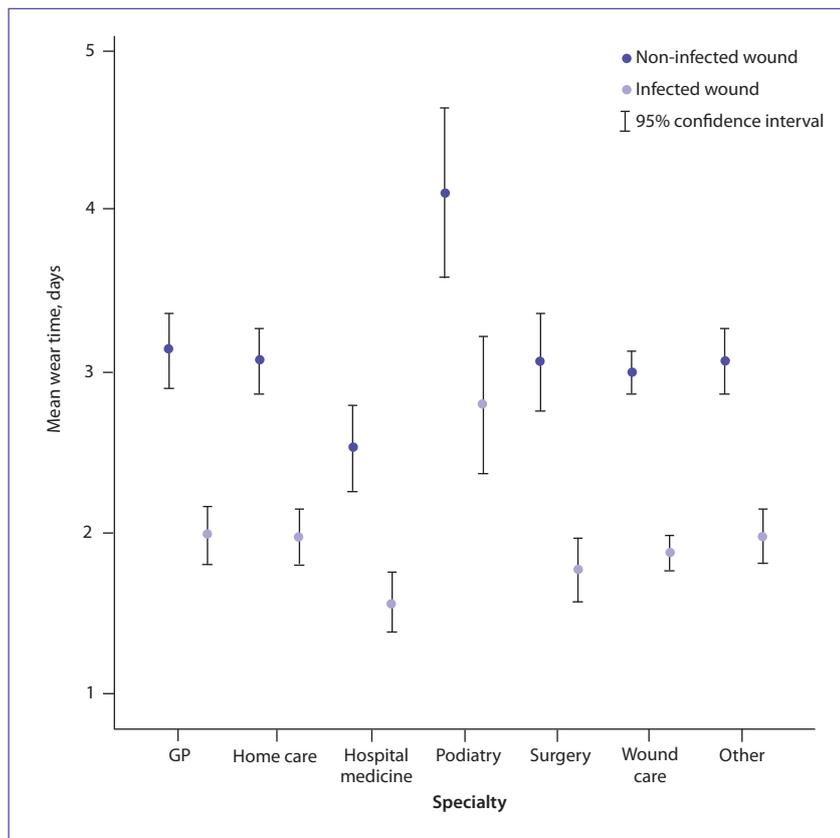


Figure 6. Typical wear times for non-infected and infected wounds by speciality.

Possible meaning of dressing wear time	Number	Percentage of respondents*
The length of time a dressing is intended to stay <i>in situ</i> as recommended by the manufacturer	247	23.5
The length of time a dressing remains <i>in situ</i> , which is often dictated by multiple factors	317	30.2
The length of time a dressing is serving a purpose (eg antimicrobial action, moisture absorption, etc)	621	59.1
The length of time a dressing remains clinically <i>in situ</i> (without rolling, leaking, etc)	103	9.8
I don't really know what 'dressing wear time' means	63	6.0

\*This column does not necessarily add up to 100, as respondents were permitted to select more than one answer.

left in place on infected wounds; around 2 days was typical for all types of wound, with the shortest length of time being 1.58 days for third-degree burns. Dressings were left for the shortest periods of time on third-degree burns, moisture lesions and deep pressure ulcers, regardless of whether or not the wounds were infected.

Mean typical wear times based on geographic area, professions and speciality, along with key parameters from the ANOVA procedures, are given in [Table 3] for non-infected wounds and [Table 4] for infected wounds. There were statistically significant differences in wear time ( $P < 0.001$ ) for both infected and non-infected wounds in relation

to geographic area [Figure 4], profession [Figure 5] and speciality [Figure 6]. Longer wear times were recorded by respondents based in the British Isles and Europe; by AHPs, by those who were not recorded in the main professional categories, and by podiatrists. This latter finding may reflect the specific and limited types of wounds generally treated by podiatrists. The narrow confidence intervals for the wear times reported by nurses and wound care specialists, see [Figure 5] and [Figure 6], reflect the large proportion of the survey sample who were wound care nurse specialists.

#### Understanding of dressing wear time

Respondents were able to select more than one option for their understanding of 'dressing wear time', as there was no, one right or wrong answer [Table 5]. The greatest proportion (59.1%) of respondents selected 'The length of time a dressing is serving a purpose (eg antimicrobial action, moisture absorption, etc)'. Around 30% of respondents selected 'The length of time a dressing remains *in situ*, which is often dictated by multiple factors'. Just 63 out of 1,673 respondents (3.8%) did not really know the meaning of dressing wear time.

#### Understanding of undisturbed wound healing

Knowledge of the meaning of the term 'undisturbed wound healing' was recorded as 'Poor' in 796 respondents (47.6%) and 'Good' in 877 respondents (52.4%). The two options with the most 'agree/strongly agree' responses were 'Undisturbed wound healing is promoting a moist healing environment that avoids maceration and wound desiccation' and 'Undisturbed wound healing is minimising the need for frequent dressing changes and leaving the dressing *in situ* for as long as possible'.

#### Relationship between knowledge of undisturbed wound healing and geographic location, profession and practice environment

Chi-squared tests for association found the following parameters were significantly associated with knowledge of undisturbed wound healing:

- Being based in Australia/New Zealand
- Being located in the British Isles
- Being a nurse or 'other' healthcare professional (ie, not being a doctor or AHP)
- Working in a hospital outpatient clinic.

These factors were included in a multiple logistic regression model for further analysis. This model found all five factors to be substantively associated with the outcome, see [Table 6], so no further refinements were made to the model.

The proportion of respondents with good or

Table 6. Logistic regression parameters associated with knowledge of undisturbed healing.

Variable	P-value	OR	95% CI for OR
Geographic location: Australia/New Zealand	0.043	1.28	(1.01, 1.61)
Geographic location: British Isles	0.054	0.791	(0.622, 1.00)
Professional category: Nurse	0.180	1.21	(0.915, 1.61)
Professional category: Other	0.046	0.498	(0.251, 0.988)
Practice environment: Hospital outpatient clinic	0.021	1.35	(1.05, 1.74)

CI = confidence interval; OR = odds ratio

poor knowledge of undisturbed wound healing is summarised in [Figure 7] based on geography and [Figure 8] based on profession. The odds of good knowledge about undisturbed wound healing in respondents based in Australia or New Zealand were about 28% higher than the corresponding odds in respondents based elsewhere in the world. The odds of a respondent having good knowledge of undisturbed wound healing was about 50% higher in nurses, doctors and AHPs than in other professions.

## Discussion

This survey evaluated the understanding and views of HCPs worldwide in relation to the concepts of undisturbed wound healing and dressing wear time. To our knowledge, this is the first survey to do this. Respondents were mainly from North America, the British Isles and Australia/New Zealand. Most of these individuals were nurses specialising in wound care, practising most commonly in a hospital ward/department or in the patient's home. The spread of data reveals that there is potential ambiguity around both of these concepts, implying that, in clinical practice, all practitioners involved in wound care need to be very clear about which attributes or aspects of care they are trying to get across. Furthermore, these findings indicate that a consensus of opinion is needed for these two concepts.

In practice, dressing wear time is related to the type of dressing used, the wound condition itself (and associated signs) and any protocol-specified change frequency. One of the current aims of wound care is to use dressings that, once *in situ*, provide undisturbed healing; too many disturbances to the wound can delay healing or even lead to adverse events, such as introducing infection and damaging the periwound skin and increased risk of medical adhesive-related skin injuries. However, as mentioned earlier, there are circumstances when it is necessary to 'disturb' wounds for inspection and management (e.g.

debridement). Less than half of all respondents in this survey said that the frequency of dressing change was specified in their wound care protocol. In these situations, respondents used their clinical judgement to determine whether or not a dressing needed changing, e.g. if the wound was malodorous. Modern foam dressings, such as the Mepilex® range (Mölnlycke Health Care), are highly absorbent and promote a moist healing environment (Rippon et al, 2012). Mepilex® dressings using Safetac® soft silicone technology in the contact layer overcome the issue of damage to the wound and periwound tissue, while still possessing a level of adhesion that safely holds the dressing in place. The tissues remain undisturbed and are not damaged when the dressing is removed (Barrett 2012; Rippon et al, 2012). Reduced dressing change frequency, in addition to clinical improvements, reduces HCP resource use, ultimately leading to cost-savings. This should be a consideration when selecting a suitable dressing for a wound.

In this survey, nurses in Australia and New Zealand appeared to have better knowledge of the concepts of undisturbed wound healing and dressing wear time than nurses in other parts of the world. Globally, all HCPs that treat wounds must take responsibility for their continuing professional development in order to keep up with changes in wound care, such as new guidelines and concepts, changed algorithms or novel dressings. However, a literature review showed that nurses lacked knowledge of the evidence base relating to the care of venous leg ulcers and that care was not conducted in accordance with the evidence (Ylönen et al, 2014). For all types of wound care there should, ideally, be a national wound care strategy followed by all practitioners. In the UK such a strategy is still in its infancy. The need for a national wound care strategy was acknowledged in a meeting chaired by Lord Hunt in November 2018 (Ousey, 2018), when it was deemed essential for multidisciplinary groups — both academic and clinical — to work together to develop a strategy that could be integrated into practice to improve patient outcomes. In Australia, in contrast, the initiative started around 25 years ago seems to have had a significant impact on wound care. The Australian Wound Management Association was formed in 1993 and now has 3,000 members from all disciplines involved in wound management (Sandy-Hodgetts and Sussman, 2016). Collaborating with local and global organisations, the Association has supported the development of a variety of documents (including several sets of clinical guidelines) that have educated and guided the national wound care

community towards optimal practice.

## Limitations

This survey has several limitations. First, the survey was written in English. It is possible that respondents whose first language was not English may have not understood or may have misunderstood some of the questions/responses, leading them to respond in an inaccurate way. This means that their responses may not be representative of what they might have answered in their own language. The software is designed to prevent individuals from responding to the survey more than once.

## Conclusion

The lack of consensus on the two wound care concepts that were integral to this survey highlights the challenges HCPs face when communicating and making informed decisions regarding wound care across patient populations, particularly in light of the many dressings now available. Considerable effort has gone into ascertaining the best clinical practice to support wound treatment, with extended wear time becoming an accepted dressing attribute that is key to undisturbed healing. It is now imperative for a consensus of opinion to be sought regarding 'undisturbed wound healing' and 'dressing wear time' so that care of the patient remains central to optimised care.

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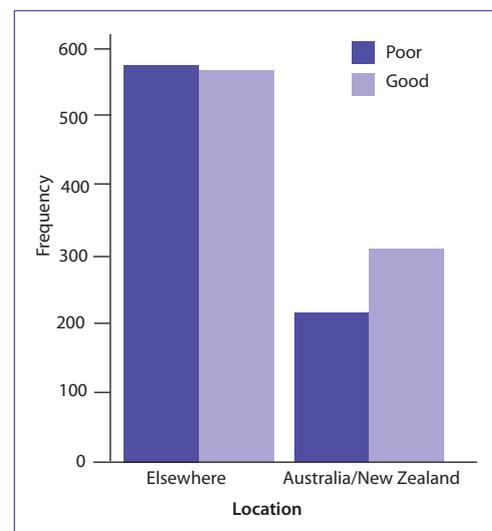


Figure 7. Knowledge of undisturbed wound healing in respondents based in Australia/New Zealand and elsewhere in the world.

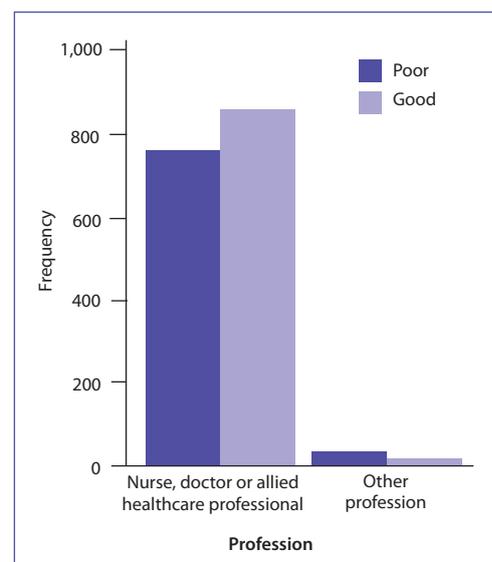


Figure 8. Respondents' knowledge of the concept of undisturbed wound healing.

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