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<https://doi.org/10.1111/jocn.15279>

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# Nurses' and surgeons' views and experiences of surgical wounds healing by secondary intention: A qualitative study

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## Funding information

This study was funded by the National Institute for Health Research (NIHR, UK) Programme Grants for Applied Research: Application RP-PG-0609-10171—surgical wounds healing by secondary intention: characterising and quantifying the problem and identifying effective treatments.

## Abstract

**Aims and Objectives:** To explore surgeons' and nurses' perspectives of managing surgical wounds healing by secondary intention.

**Background:** Every year, more than 10 million surgical operations are performed in the NHS in the UK. Most surgical wounds heal by primary intention, where the edges of the wound are brought together with staples, sutures, adhesive glue or clips. Sometimes wounds are deliberately left open to heal, from the base up, known as "healing by secondary intention." These wounds are often slow to heal, prone to infection and complex to manage.

**Design:** A qualitative, descriptive approach, using semi-structured interviews.

**Methods:** Interviews with five (general, vascular and plastic) surgeons and 7 nurses (3 tissue viability nurses, 2 district and 1 community nurse, and 1 hospital nurse) working in hospital and community care settings in two locations in the north of England. Data analysis followed the recommended sequential steps of "Framework" approach. Consolidated criteria for reporting qualitative research guided the study report.

**Results:** Participants reported that the main types of wounds healing by secondary intention that they manage are extensive abdominal cavity wounds; open wounds relating to treatment for pilonidal sinus; large open wounds on the feet of patients with diabetes; and axilla and groin wounds, associated with removal of lymph nodes for cancer. Infection and prolonged time to healing were the main challenges. Negative pressure wound therapy was the most favoured treatment option.

**Conclusions:** Negative pressure wound therapy was advocated by professionals despite a lack of research evidence indicating clinical or cost-effectiveness. Our findings underscore the need for rigorous evaluation of negative pressure wound therapy, and other wound care treatments, through studies that include economic evaluation.

**Relevance for clinical practice:** Clinical decision-making in wound care could be optimised through further robust studies to inform practitioners about the cost-effectiveness of available treatments.

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**KEYWORDS**

healing by secondary intention, nurses, open surgical wounds, qualitative, surgeons

**1 | INTRODUCTION**

Every year, more than 10 million surgical operations are performed in the National Health Service (NHS) in the United Kingdom (UK) (NHS Consideration, <http://www.nhsconfed.org/resources/key-statistics-on-the-nhs>). Most surgical wounds heal by primary intention, that is to say, the edges of the surgical incision are closed together, using stitches or clips, until the cut edges unite (Salcido, 2017). Healing of an open surgical wound that takes place from the base of the wound upwards, through the formation of new tissue, is called "healing by secondary intention."

Surgical wounds heal by secondary intention for a variety of reasons. It may have been planned at surgery to leave the wound open to heal by secondary intention, or a wound that was closed after surgery can break down (dehiscence), due to infection, for example. The types of wounds that are sometimes left open to heal include those resulting from excision of infected soft tissue such as pilonidal sinuses (Al-Khamis, McCallum, King, & Bruce, 2010) and breast abscesses (Lewis, Whiting, ter Riet, O'Meara, & Glanville, 2001). Concurrent infection is a recognised risk factor for dehiscence of closed abdominal wounds (Sandy-Hodgetts, Carville, & Leslie, 2013; Spiliotis et al., 2009) where the edges of the surgically closed wound split apart, leaving the wound open. Wounds resulting from colorectal surgery are particularly prone to dehiscence due to infection (Chetter et al., 2019; McLaws, Murphy, & Whitby, 2000; Tanner et al., 2009), resulting in full or partial separation of the wound edges, which may then be left to heal through secondary intention, or closed surgically after partial healing (National Institute for Health and Care Excellence (NICE), 2013).

**2 | BACKGROUND**

Until very recently, data concerning the epidemiology of surgical wounds healing by secondary intention (hereafter referred to as open surgical wounds) have largely been absent, both for the UK and globally. Two published audit studies originating in the North of England, UK, one in Bradford (Vowden & Vowden, 2009) and one in Hull (Srinivasaiah, Dugdall, Barrett, & Drew, 2007) estimated that open surgical wounds made up approximately 28% of all prevalent acute (mainly surgical/traumatic) wounds receiving care. Hall et al. (2014) reported a point prevalence of dehiscent surgical wounds of 0.07 per 1,000 population in a UK city with a population of 751,485. Chetter, Oswald, Fletcher, Dumville, and Cullum (2017) measured the prevalence of open surgical wounds over a two-week period in primary, community and secondary care settings and found a prevalence of 0.41 per 1,000 population (total population 590,585), with almost half of the wounds planned to heal by secondary intention. Results from a prospective cohort study with 393 patients with surgical

**What does this paper contribute to the wider global clinical community?**

- Little is known about the clinical management of surgical wounds healing by secondary intention.
- This study explores the views and experiences of surgeons and nurses regarding management of these wounds and associated challenges.
- Negative pressure wound therapy was the preferred treatment option.
- Findings underscore gaps in the evidence base relating to clinical and cost-effectiveness of negative pressure wound therapy and other wound care treatments.

wounds healing by secondary intention who were followed up for at least 12 months (Chetter et al., 2019) indicate that prolonged healing times (median time to healing of 86 days) and adverse events (e.g. wound infection) are common, impacting on patients' health-related quality of life.

Open surgical wounds can be challenging to manage, as they are often large, deep, prone to infection and produce copious amounts of exudate (Dumville, Owens, Crosbie, Peinemann, & Liu, 2015), yet a strong evidence base to guide the management of these wounds is currently lacking (Dumville et al., 2015; National Institute for Health and Clinical Excellence (NICE), 2008). They are often managed with a variety of dressings, requiring patients to undergo frequent dressing changes, and, sometimes, painful packing of the wound. Different dressing options include simple dressings, such as non-adherent dressings, and more modern options such as foam, hydrocolloid, alginate or negative pressure dressings. Negative pressure wound therapy (NPWT) is a system that comprises a nonadherent, porous wound dressing (such as gauze or foam), with a transparent film to seal the wound, and a drainage tube that is connected to a vacuum source to exert negative pressure. Negative pressure is increasingly used and has been claimed to promote wound healing by removing exudate and reducing infection, although there is a lack of robust evidence to support these claims (Dumville et al., 2015). Open surgical wounds may also be treated by further surgical intervention, such as debridement and skin grafting, which may require patients to be hospitalised, with implications for quality of life (Sandy-Hodgetts et al., 2013; Smith, Dryburgh, Donaldson, & Mitchell, 2013).

Data from randomised controlled trials on treatments for surgical wounds are limited and difficult to interpret, due to trials being underpowered and poorly designed, and evidence to suggest that any one dressing is better than another is currently lacking

**TABLE 1** Details of sample of surgeons and nurses

| Surgeons   |            |        |   |  |  |
|--|------------|--------|---|--|--|
| ID   |            | Gender |   | Study site   | Type of surgery  |
| General Surgeon 1 (GS1)  |            | Male   |   | SITE-A   | General surgery  |
| General Surgeon 2 (GS2)  |            | Male   |   | SITE-B   | General surgery, specialises colorectal surgery  |
| Vascular Surgeon 1 (VS1)   |            | Male   |   | SITE-A   | Vascular surgery   |
| Vascular Surgeon 2 (VS2)   |            | Male   |   | SITE-B   | Vascular surgery   |
| Plastic Surgeon (PS)   |            | Male   |   | SITE-A   | Plastic surgery  |
| Nurses (TVN: tissue viability nurse; SS: senior sister; DN: district nurse; CN: community nurse) |            |        |   |  |  |
| ID   | Study Site | Gender | Qualifications  | Role   | Specialist training  |
| TVN1   | SITE-A     | Female | RN; BA (Hons); specialist practitioner—district nursing; nurse prescriber | Tissue viability nurse specialist ( <i>assessment; care planning; evaluation; prescribing; liaison with surgeons; supporting nurses and patients</i> ) | Diploma in wound care and ulcer management   |
| TVN2   | SITE-A     | Female | RN; BSc (Hons); diploma in nursing; nurse prescriber.                     | Clinical/tissue viability nurse specialist ( <i>education; training; support for colleagues</i> )  | None   |
| TVN3   | SITE-A     | Female | RN; BSc (Hons); district nurse; nurse prescriber                          | Tissue viability nurse specialist ( <i>assessment of complex surgical wounds; instigation and monitoring of negative pressure wound therapy</i> )      | None   |
| SS   | SITE-B     | Female | RN  | Senior sister, acute general surgery ward with patients with abscess/fistulas/wound dehiscence   | Training from “VAC” therapist employed by the hospital trust and from commercial representatives |
| DN1  | SITE-B     | Female | RN; district nurse  | Treatment room nurse   | Study days; experience; leg ulcer management course  |
| DN2  | SITE-B     | Female | RN; district nurse  | District nurse; Link nurse for tissue viability  | Study sessions related to Link Nurse role  |
| CN   | SITE-B     | Female | RN  | Community staff nurse (caseload includes wound care)   | Course on wound management   |

(Dumville et al., 2015; Vermeulen et al., 2004). Additionally, results from a systematic review (Norman, Dumville, Mohapatra, Owens, & Crosbie, 2016) highlight the lack of evidence concerning the relative effectiveness of any antiseptic/antibiotic/antibacterial preparation evaluated to date for use on open surgical wounds (Norman et al., 2016). Given the potential complexity, size and slow nature of healing of open surgical wounds, interest in alternative treatment options is high, yet open surgical wounds are under-researched. Surprisingly, we know little about clinicians' rationale for selecting treatments for open surgical wounds, or of the challenges they face in promoting healing. The prime aim of our exploratory study was therefore to explore and elicit the perspectives of clinicians (surgeons and nurses) with responsibility for caring for patients with open surgical wounds. The study reported here sites within a wider programme of work that addresses broader knowledge gaps linked to open surgical wounds (Chetter, Arundel, Bell, Buckley, & Klaxton et al., In press) and the study findings complement those relating to patients' experiences of living with an open surgical wound (McCaughan, Sheard, Cullum, Dumville, & Chetter, 2018).

### 3 | METHODS

An exploratory qualitative approach was adopted to gain new insights into a phenomenon about which little is known (Pope & Mays, 2006). Semi-structured interviews were used to allow for flexibility in data collection, permitting the researcher to explore how the participants make sense of the topic under investigation (Flick, 2014).

#### 3.1 | Setting and sample

The study sample was drawn from two centres in the north of England and included clinicians working in hospital and community care settings. Potential participants were contacted via clinical networks, email and telephone, and sent an information leaflet about the study, with a request to contact the researcher if they were interested in taking part. The total study sample included five surgeons and seven nurses, purposively sampled from amongst health

professionals with responsibility for caring for patients with open surgical wounds (see Table 1 Details of study sample).

### 3.2 | Data collection

Interviews took place from January–August 2012 and were facilitated by a short, semi-structured topic guide (see Appendix S1) based on the research questions and the experiences of the research team. Probes were used to elicit more detail and depth of information on each topic. Our aim was to illuminate the phenomena under investigation, rather than to reach data saturation (Baker & Edwards, 2012). DM and LS conducted interviews at participants' place of work. Surgeons' interviews ranged from 30–45 min, and nurses' from 60–75 min. All interviews were audio-recorded, fully transcribed and checked for accuracy.

### 3.3 | Data analysis

Data were analysed for thematic content using "Framework" approach, regarded as particularly well-suited to generating clinical practice-oriented findings (Gale, Heath, Cameron, Rashid, & Redwood, 2013). We followed the recommended sequential steps of familiarisation with the data, thematic analysis to develop a coding scheme, indexing and charting of data, which involved rearranging data according to thematic content. [Anonymised] and [anonymised] met frequently to discuss expansion and modification of the coding frame. Data handling was facilitated by the use of electronic spreadsheets to summarise and chart data and allow for comparison within and between cases. Analysis was both systematic and iterative; we looked for similarities and differences across the data set, making connections and identifying salient themes. Our aim was to remain close to participants' accounts while moving towards a coherent interpretation of the complete data set. Active seeking of "negative" cases, that is to say, elements in the data that seem to contradict the emerging explanations, helped to refine the analysis (Mays & Pope, 2000). Use of reflective notes and memo-writing throughout the analytic process also enhanced rigour of the study (Barbour, 2001).

### 3.4 | Researcher characteristics

DM is a registered nurse and LS a sociologist; both are experienced in applied health services research using qualitative methods. The different backgrounds of the researchers did not result in significant differences in data collection or interpretation.

### 3.5 | Data reporting

Findings are reported according to consolidated criteria for reporting qualitative research guidelines (Tong, Sainsbury, & Craig, 2007) (see Supplementary File S1).

### 3.6 | Patient and public involvement

Patient advisors were instrumental in shaping the design of the overall programme of work in which this study sits.

### 3.7 | Ethics

The study received research ethics approval via the Integrated Research Application System. All study participants were given verbal and written information relating to the study aims and their involvement. Written consent was obtained and participants were given assurances concerning the confidentiality and anonymity of their responses. It was made clear to participants that they could withdraw from the study at any time without giving a reason.

## 4 | RESULTS

### 4.1 | Surgeons' perceptions

(GS: general surgeon; PS: plastic surgeon; VS: vascular surgeon).

#### 4.1.1 | Factors thought to influence the development of open surgical wounds

Surgeons described the types of wounds associated with the various operations they perform. The main types of open surgical wounds identified were extensive abdominal cavity wounds (e.g. laparoscopy wounds and/or dehisced surgical wounds); cavity wounds after pilonidal sinus surgery; large, open wounds on the feet of patients with diabetes; axilla and groin wounds, associated with removal of lymph nodes for cancer. These wounds were generally perceived as slow to heal, particularly the open surgical wounds that result from colorectal surgery that are prone to infection.

*this sort of intrinsic diabetic poor healing often takes months to heal and there are a number of patients...with wounds failing to heal for 18 months or longer.*

(VS1)

*it's [slow to heal wounds] not an uncommon situation, particularly with acute surgery and particularly with post-operative complications...obviously with colorectal surgery our surgical site infections are quite high because it tends to be dirty surgery.*

(GS2)

Surgeons broadly agreed on a range of factors that contribute to slow/lack of healing, including emergency surgery, infection, obesity and other risk factors such as patients' nutritional and smoking status,

age, diabetes, cancer, arterial and/or vascular disease, restricted mobility, impaired immune system and medication.

*often the unhealed ones [wounds] are the emergency operations...whereas the elective patients are people that are planned to come in, infection and breakdown occurs, but it is less common.*

(GS1)

*in terms of that sort of superficial dehiscence with big subcutaneous fat layer, big deep cavity, you only really see that in these super obese patients.*

(GS2)

*malnutrition, being elderly, poor blood supply and vascular diseases, smokers, diabetics...people with poor mobility... are traditionally seen as things which slow the whole process right down... people on drugs, steroids...I think these factors do play a role.*

(GS1)

#### 4.1.2 | Surgeons' role in management of open surgical wounds

Two contrasting approaches to management of open surgical wounds were described by surgeons: devolving responsibility for wound care to community nurses, and an approach encapsulated in the phrase "looking after our own."

General surgeons commented that the level of their involvement with wound management in the immediate postoperative period is closely linked to the nature of the surgery that has been carried out, the patient's general condition and condition of their surgical wound. In most cases, nurses would assume responsibility for patients' open surgical wound care after their discharge from hospital, with more intensive follow-up by surgeons of patients whose wounds were not healing as well as expected. Contrastingly, vascular and plastic surgeons commented that patients with diabetes and open wounds on the foot, or those undergoing plastic surgery, would have routine intensive follow-up by surgeons and nurses working in these specialities, referred to as "looking after our own." Vascular surgeons, for example, reported routinely measuring and documenting wound status during patients' follow-up visits, while the plastic surgeon (PS) described intensive follow-up of patients through specialist plastics clinics for postoperative patients, where patients would be seen frequently by a consultant and/or specialist nurses until their wound(s) healed.

*plastic dressing clinic is basically my post-operative patients, so they'll come on a weekly basis until they're healed...they're under the care of a consultant...and they'll stay with us until they are healed. We don't discharge anybody to the community. We don't discharge*

*anybody to the tissue viability nurses. We look after our own.*

(PS)

#### 4.1.3 | Assessment of open surgical wounds

During interview, surgeons provided detailed accounts of typical assessments of an open surgical wound that they might carry out to determine healing processes. Indicative factors related to the size of the wound; whether the wound is infected; presence of slough in the wound; whether the wound appears to have healed superficially, but remains unhealed at a deeper level; presence or absence of granulation tissue; level of exudate; the condition of the wound edges; the patient's general condition, including nutritional state and ability to mobilise; signs of overgranulation; whether the wound seems "static" and/or appears to be colonised; blood supply at the wound site. Figure 1 provides detailed description of a wound assessment drawn from the interview with GS1, which is illustrative of reports from all of the surgeons.

#### 4.1.4 | Selection and experiences of treatment(s) for open surgical wounds

Surgeons' knowledge concerning dressings for open wounds was, by their own admission, limited. General surgeons 1 and 2 said they relied on nurses to make decisions about appropriate dressings because it is difficult to "keep up to speed" with all the new products coming on to the market, and various dressings "go in and out of fashion." General surgeon 1 commented that he does not see commercial representatives in connection with dressings, though he thought they might be a source of information for nursing staff about new products.

*I'll admit a degree of ignorance here...I would normally leave that to my nursing staff...they sort the wounds out.*

(GS2)

*various things go in and out of fashion...as the years have gone on I've relied more on being told what is the dressing to be used...I am aware of the basics but I'm not quite up to speed with the detail.*

(GS1)

One treatment option, NPWT, was favoured above others. Use of NPWT (or "VAC" or "VAC pac" as it was often referred to) was said to be increasing, and surgeons described complex, cavity wounds which were likely to be slow to heal (e.g. extensive abdominal wounds associated with laparostomy or large, deep wounds to the feet of patients with diabetes), as "ideal candidates" for NPWT.

*'I don't formally measure it, so I don't get a ruler out, I could do I suppose, but more often than not people will tell me because they've been keeping an eye on it, and they will know whether it's bigger or smaller or the same size, so I don't feel the need to measure it. What I'm particularly interested in is a number of things; is there any infection, so if there is, I need to set about draining that, that's one of the most important things and that can occur if the skin heals over the top before it's healed below. So if it shows signs of that, then I will open it out again and break down any healed skin, if there's a cavity underneath it, deliberately do that to let any infection out. I'm looking for granulation tissue at the base of the wound and round the edges and I'm always pleased when I see lots of that, it's healthy. I'm looking at the wound edges to see whether indeed they look healthy and pink and whether they're active really, active and healing. I think those are the things I look for. Occasionally it would look as though the wound has actually healed apart from a tiny little spot and those are the ones that we've got to be very careful about because it's those where it's healed over the top first and there's a cavity underneath, so I always give it a good prod and poke with something. Now, we used to have a thing called a sinus probe and they're few and far between these days, so I use a thing called a microbiology swab which has got like a very long Q-tip and it's used for taking swabs and then sending off to the lab and I use that to open out holes and make them bigger, it works beautifully, seeing as we've got rid of sinus probes. I think that's all I look for really. I look at the patient, of course, to see whether they look better than the last time I saw them and make sure, to see if they look nourished, see if they look fitter, all of those things which would indicate, of course, that they've got the resource to heal their wound. If they're looking dreadful then they're not going to heal their wound no matter how small it is...over-granulation, that is something to look out for in wounds, it's usually not too much of a problem but it does slow down healing...'* (General Surgeon 1)

**FIGURE 1** Detailed description of wound assessment (General Surgeon 1)

*we do use negative pressure wound increasingly...the plastic surgeons for a long period of time have used negative pressure wound therapy... and colorectal surgeons use negative pressure systems a lot for the laparotomy type situation.*

(VS2)

*my personal preference is to use vacuum assisted pressure dressing, the abdominal VAC dressings...I'm a big fan of VAC dressing.*

(GS2)

Preference for NPWT was linked to personal experience of positive outcomes of treatment, patient perspectives, and perceived implications for healthcare resources. Surgeons commented that they believed that NPWT controlled wound exudate, sealed the wound (thereby potentially lowering risk of infection), supported the growth of granulation tissue, and generally hastened wound healing. They also thought that its use enhanced patients' quality of life, through increased convenience (due to a reduced need for dressing changes) and promotion of patient mobility. Additionally, surgeons associated NPWT with shorter in-hospital patient stays and reduced community nurse workload, as well as an earlier return to work for patients, and they therefore inferred cost-effectiveness. Overall, surgeons viewed NPWT as a cost-effective and revolutionary approach to the treatment of hard to heal, open surgical wounds.

*my own personal preference is to use VAC.*

(GS2)

*VAC has revolutionised the management of the large wound... it increases healing, it's got all sorts of proven roles in improving the healing process. It physically shrinks the wound down... encourages granulation tissue...a VAC-able wound might close in 1 month whereas by secondary intention with open packing it will be 3 to 6 months.*

(PS)

*it's [NPWT] got to be cheaper than £400 per day in hospital.*

(VS2)

*the [patient] has had about 3-4 weeks off [work] in total as opposed to months and months to heal.*

(PS)

A major drawback of NPWT highlighted by general surgeons was a perceived risk of intestinal fistulation in patients with large abdominal cavity wounds, such as those associated with deep dehiscence or laparostomy. General surgeon 1 referred to a recent report of an audit of clinical practice that suggested it was safe to use NPWT on this type of wound, though he harboured reservations.

*the risk of course with intestines is that the negative VAC pressure will cause the intestines to fistulate, so that's the big worry...though there is some data presented last*

*week at the Association of Surgeons [conference] that would suggest the risk is no greater than not using it.*

(GS1)

Other perceived disadvantages to use of NPWT were its lack of suitability for patients who are frail or have cognitive impairment, while service-related disadvantages included limited availability of the necessary equipment in the community and its high cost.

#### 4.1.5 | Perceptions relating to evidence to support use of NPWT and other types of dressings

Three of the five surgeons highlighted the lack of research evidence to support NPWT, yet they felt that their own and colleagues' experience supported its use; a perception reinforced by its increasingly widespread and seemingly safe use in clinical practice.

*it's very anecdotal...I mean if you look for the evidence of VAC there isn't a lot of evidence for it...but in my experience I think it does speed up granulation of tissue formation and sort of artificially stimulate cicatrisation and smallerisation [sic] of the wound.*

(GS2)

The plastic surgeon interviewed commented that sufficient evidence is already currently available to unequivocally support the use of NPWT. This surgeon referred to a number of studies which they believed demonstrated its effectiveness and contrasted increasing use of NPWT in the plastics specialist outpatient clinics and elsewhere in the hospital, with "old fashioned packing" of wounds, which, he said, was becoming increasingly rare. This surgeon, the strongest advocate of NPWT amongst those interviewed, stated that the advent of NPWT had "changed practice considerably."

*Louis Argenta...Argenta's paper from America... he has got numerous papers on VAC...you'd have to read the Louis Argenta paper for the advantages of VAC.*

(PS)

[Louis Argenta is a surgeon who was involved in the commercial development of systems designed to deliver NPWT].

*we're leaving a lot less wounds to old fashioned packing with dressings...now we put VAC on and the whole thing is a lot cleaner and better. (PS)*

Three surgeons referred to receiving information from representatives from commercial companies manufacturing products used in the application of NPWT.

*Reps for VAC therapies...I've seen enough of those!*

(GS1)

The prevailing lack of robust evidence to support treatment choices in the care of slow to heal or nonhealing open surgical wounds was highlighted by venous surgeon 2:

*I think chronic wounds requiring secondary intention healing is an area that has been extremely well ignored over the past 50 years...the evidence base is usually based on some sort of case studies as opposed to competitive randomised controlled trials and certainly very rarely dressing to dressing, so the evidence is based on 'I've seen 10 patients on who it worked really well, thank you very much'...and then there is a bit of experience, things you have used for a long period of time and know work reasonably well.*

(VS2)

#### 4.2 | Nurses' perceptions

(TVN: tissue viability nurse; SS: senior sister; DN: district nurse; CN: community nurse).

##### 4.2.1 | Types of open surgical wounds perceived as likely to be slow to heal

Agreement was widespread amongst nurses that wounds resulting from abdominal surgery (particularly colorectal surgery, or surgery to repair a hernia) were more likely to be slow to heal, or nonhealing, than other types of open surgical wounds, and that these were also the type of wound most likely to dehisce. Other open surgical wounds cited as sometimes slow to heal were wounds resulting from Caesarean section, or those that follow treatment for a fistula, perianal abscess or pilonidal sinus.

*the non-healing wounds are usually associated to abdomens, hernia repairs and things that have burst open...*

(TVN2)

*it's the fistulas that don't heal...*

(SS)

*they tend to be mainly the perianal abscesses [that are slow to heal].*

(DN1)

*we tend to get quite a lot of dehisced wounds post-surgery...we get a lot of hernia repairs, we get a few C-sections...*

(DN2)



Factors cited by nurses as potentially implicated in poor healing of open surgical wounds overlapped closely with those identified by surgeons: "complexity" associated with comorbidities (such as Crohn's disease), the reason for surgery (e.g. people who experience perforated bowel), the nature of the surgical procedure (patients left with large, deep, cavity wounds), presence of a "foreign body" (e.g. retained surgical mesh), obesity, wound infection, age and general health and lack of concordance with treatment. Figure 2 provides illustrative quotations relating to nurses' views of factors implicated in slow healing of open surgical wounds.

#### 4.2.2 | Assessment of open surgical wounds

A range of factors were taken into account by nurses during assessment of a patient with an open surgical wound, including wound size and duration, state of the wound bed and type of tissue in the wound, presence or absence of granulation tissue, levels of exudate, wound pain, wound odour, signs of infection, condition of surrounding skin; patient mobility and hygiene needs; diet and nutritional status; general levels of comfort; the patient's feelings about their quality of life; whether family members are likely to be involved in wound care; and the patient's potential for self-care of the wound.

Due to time constraints, hospital, district and community nurse participants' main focus was on assessment of the condition of the patient's wound; a single study participant (district nurse 2) mentioned using a wound-specific assessment tool (Dowsett & Newton, 2005; Watret, 2005) when carrying out first-time visits to

patients. Tissue viability nurses reported having more time to conduct a broader, holistic assessment that encompassed consideration of patients' wider care needs: "*all the things that matter to patients, and not just what we put on the wound*" (TVN1).

#### 4.2.3 | Nurses' role in management of open surgical wounds

Tissue viability nurses regarded themselves as the "*first port of call*" (TVN3) for community-based nurses seeking expert advice on wound care for patients with open surgical wounds, a perception that was reflected in comments from district and community nurses that they would refer patients for assessment by tissue viability nurses if wound healing appeared to have stalled or stopped.

*They [community nurses] refer to us if they've been seeing the patient and they're not improving they'll refer to us for assessment.*

(TVN2)

In some cases, patients might be referred to tissue viability nurses almost immediately on discharge from hospital, depending on the nature of the surgical procedure undertaken and associated complexity of the open surgical wound. In these instances, tissue viability nurses said they would liaise with the operating surgeon to obtain detailed information about the patient's background and the history of the wound to inform decisions on management.

*'complex patient, probably had some complex bowel surgery, perhaps perforated bowel, history of infection, undernourished, lots of other things that have gone on with that type of surgery...been very unwell, very acutely unwell, unplanned, and for whatever reason, has gone on not to heal.'* (TVN1)

*'if they've got poor prognosis from the cancer point of view...or if they've had multiple operations...'* (TVN3)

*'colorectal fistulas are very debilitating...the bowel breaks down and the gut breaks down and they have to have TPN [total parenteral nutrition]...they take months to heal.'* (SS)

*'you do tend to see the diabetic patients and you know that they are going to be slower to heal...if their sugar levels are up you know that the healing is not going to be quite as brilliant.'* (DN1)

*'a lot of it is due to patients with co-morbidities or who've had previous surgery...'* (DN2)

*'we've had one patient and the wound does heal up and then it sort of pops again...it's healing but it's not healing underneath, so there is something underlying...'* (CN)

*'I think people that are overweight, are going to run into problems...it's those wounds that don't heal very well.'* (DN1)

*'you find with the abdos, if they've had a dehisced hernia repair and they've taken the mesh out because it's been infected, they don't seem to have a base of granulation tissue...it's just body cavity that you see...it's not going to knit together...so they are left with this hole basically...sometimes they do eventually heal, but it's a long haul...'* (TVN2)

*'We have had quite a few wounds with infection, infected surgical wounds, whereby obviously the healing process is hindered because of the infection, so it takes longer to heal...'* (DN2)

*[non-compliance] 'there was a gentleman... he insisted on taking dressings off, fiddling about with dressings in between visits and for all the goodwill in the world, we can say to people, don't touch it until the nurse comes but then sometimes you get there and they've taken it off...'* (DN2)

**FIGURE 2** Nurses' views of factors implicated in slow healing of open surgical wounds

*it's usually the abdominal wounds, post-surgery. Complex patient, probably had some complex bowel surgery, perhaps perforated bowel, history of infection, under-nourished, lots of other things that have gone on with that type of surgery...very acutely unwell...*

(TVN1)

#### 4.2.4 | Challenges associated with management of open surgical wounds

Nurses were asked for their views and experiences of how long open surgical wounds might take to heal. As noted above, the types of wounds said to take a long time to heal were deep cavity wounds, pilonidal sinuses and perianal abscesses, and wounds arising from hernia repairs where surgical mesh was inserted during the operation, which were said to take weeks, months or even years to heal. Wound healing was described as often difficult to achieve.

*open cavity wounds can take a long, long, time...they [patients] are left with this hole basically... sometimes they do heal, eventually, but it's a long haul...it could take years.*

(TVN2)

*colorectal fistulas are very debilitating...the bowel breaks down and the gut breaks down...they take months to heal.*

(SS)

*it was a hernia repair...down to the mesh...a really, really nasty wound that took a long time to heal...*

(SS)

Wound healing was reported as sometimes unpredictable and erratic; nurses commented that a wound may progress well, stop healing for a period with no obvious reason (referred to as "stasis") and then re-commence healing. Stasis was said to sometimes occur after removal of NPWT. Nurses also described instances where an open wound had almost completely healed, except for a small "hole" which persisted, and partially healed wounds that continued to "gape" in one area. An additional factor said to delay the final stages of wound healing was overgranulation.

*patients are told it [NPWT] will completely heal the wound and it only heals it part of the way, and then when we take it off, they're anxious that it's slowing down...*

(TVN3)

*one particular patient that had a hernia repair, 4 years ago now, had VAC at that point, he's still got a wound*

*and he's been to plastics. I mean the area has reduced, it's only 1 by 1 [inches] but it's still there and the surgeon has said that basically it's never going to heal up.*

(TVN3)

*the flesh had grown but the skin can't close over the top, it bulges, and it's quite pink and bleeds quite easily... it [over-granulation] just slows down the final stages of healing.*

(DN1)

#### 4.2.5 | Selection and experiences of treatment(s) for open surgical wounds

Nurses perceived their approach to management of open surgical wounds as evidence-based and influenced by a wide array of factors, some wound-specific, some patient-specific (including psychosocial factors and family circumstances) and some related to perceived cost-effectiveness of specific dressings. Factors taken into consideration included the following: the site, size and nature of the wound; the condition of the wound bed (clean or sloughy); exudates from the wound (amount and nature); presence of infection and/or odour; condition of surrounding skin; patient reporting pain; patient comfort; hygiene needs; patients' lifestyle; patient's potential for self-care (or involvement of family member).

Individual nurses' choice of wound care products appeared to be based on their knowledge of local guidance, manifest in formularies and protocols, whose recommendations nurses regarded as evidence-based. Tissue viability nurses reported that their involvement in compilation and development of these resources for use by other nurses influenced their own choice of dressings.

*our protocol is 2 weeks of a silver dressing if there is any infection and then re-assess it...*

(DN2)

*I think doing the wound care infection guidelines had helped me with my decision making...we've got an algorithm now in the community...it does give the nurses a bit of an idea when they should be actioning antibiotics and when not and when to put antimicrobials on...*

(TVN2)

Additionally, all of the nurses interviewed mentioned drawing on colleagues' expertise to support decision-making for wound management.

*I'll start off with our 'First Choice' dressing list first, because they are usually the things that work and if they're not doing their job, I'll ask my colleagues...*

(TVN2)

Nurses acknowledged that one of the functions of local guidance was to contain costs but indicated that patients' needs would be carefully considered when choosing between different treatment options, and the cheapest would not automatically be selected. Dressings not contained in the local formulary might be obtained via a doctor's prescription.

*obviously there is a push for being cost-effective...however, it's what the patient need is...Aquacel is quite a reasonably priced dressing...if we needed to use silver, that's considerably more expensive but that wouldn't waver us using it.*

(DN1)

*Our initial assessment we tend to choose dressings off our formulary and we have justification products which are like your silver products, antimicrobials, that type of thing, and anything other than that usually gets prescribed via the consultant or the GP.*

(DN2)

#### 4.2.6 | Perceptions of desirable characteristics of treatment options

Dressings described as frequently used by nurses included Aquacel (to control exudate); Aquacel ribbon (to pack a pilonidal sinus related wound); charcoal dressing (to control odour); dressings that debride the wound; and silver dressings for wounds that are not healing and appear to be "sub-clinically infected." Aquacel dressing (and Aquacel ribbon) was frequently cited as nurses' first choice for packing cavity wounds, though some nurses linked their use with overgranulation. Nurses reported that patients whose open surgical wounds were being packed after treatment for pilonidal sinus experienced less pain when their cavity wound was packed with Aquacel ribbon rather than gauze.

#### 4.2.7 | Nurses' perceptions of Negative Pressure Wound Therapy

Six of the seven nurses viewed NPWT as effective in the management of open surgical wounds. Patients who might otherwise have to remain in hospital for twice daily dressing changes were said to go home to the care of the district nursing service and require fewer dressing changes with NPWT than with "traditional" dressings. Other perceived benefits of NPWT related to management of wound exudate, and the good "seal" on the wound that might be attained, preventing leakage, and (it was felt) promotion of the growth of granulation tissue.

*for a lot of patients NPWT is very effective... rapid growth [of granulation tissue], excellent for managing exudate... gets them out of hospital quicker, only needs doing twice*

*or 3 times per week, whereas if they weren't on VAC it would probably be at least twice a day and they would still be in hospital...*

(TVN1)

According to the senior ward sister (SS) in study SITE-B, acute care nurses often have limited knowledge of using NPWT, at least on the ward where she works, and they look to the hospital-based tissue viability nurse for support.

*there's maybe just a small number of us who can do it... tissue viability will come and support you...*

(SS)

This senior hospital-based nurse also expressed the view that district/community nurses have wide experience of the use of NPWT, an opinion that was at odds with the views of the tissue viability nurses in study SITE-A, who commented that these nurses often need guidance in application of NPWT from tissue viability nurses and/or from patients who have become expert in its use.

*the district nurses know what they are doing...there's a lot of training for them in the community and they're very up on how to look after and care for them.*

(SS, SITE-B)

*some [patients] have been in hospital with it [NPWT] for quite a long time and manage the VAC-pac themselves and almost direct the nurses on how to do it because they've watched 5, 6 10 nurses on the ward and they say, 'no, you do it this way'*

(TVN3, SITE-A)

Tissue viability nurse 1 described working alongside district and community nurses when carrying out assessments of wounds regarded as complex and/or nonhealing, to improve their knowledge of managing these wounds and to provide "hands-on" instruction in application of NPWT.

*if I've got a patient on VAC...I might need to re-teach the nurses to cut the foam...all my visits, where possible are done jointly with the [patient's] primary nurse, so that there is always a discussion, a question and answer session*

(TVN1)

Only one of the nurses (tissue viability nurse 3) expressed strong reservations about NPWT as a universally beneficial treatment for patients with (usually dehiscenced abdominal) open surgical wounds. This nurse's experience of using "VAC" did not concur with its promotion as "the answer to everything" in the management of difficult to heal wounds, and she felt that it was sometimes "oversold" to

patients by hospital staff, raising unrealistic expectations for wound healing. In her experience, longer-term healing of an open surgical wound could be impeded by the use of NPWT compared to conventional dressings. Tissue viability nurse 3 suggested that the use of foam (rather than gauze) in the application of NPWT could be detrimental to healing through the formation of less “robust” granulation tissue.

*things like topical negative pressure has become like the answer to everything, but it's not... patients are told it will completely heal the wound and it only heals it part of the way and then when we take it off they're quite anxious ...*

(TVN3)

*I think surgical wounds seem to do slightly better using the gauze system... as opposed to the foam...I have noticed that the foam tends to cause the granulation tissue to not be as robust so I think that in a way tends to slow healing down...*

(TVN3)

Like the surgeons, tissue viability nurse 3 also referred to a need for caution when considering use of NPWT in patients who might be at risk of developing a fistula following bowel surgery and/or patients with active cancer.

*with using the topical negative pressure, you've got to consider, have they got an active cancer because the actual process [of using NPWT] is encouraging the cancer cells to grow...with perforated bowels for rectal and bowel tumours, for that type of surgery, you end up with a risk of fistula...there is evidence of an increased risk of fistula...*

(TVN3)

Disadvantages of NPWT from a patient perspective mentioned by nurses were anxiety and disruption to sleep caused by the alarm “bleeping,” and restrictions to mobility, even with “portable” devices, as physically frail patients could find it difficult to manage the equipment. Tissue viability nurse 1 suggested that patients’ tolerance for NPWT can be short-lived. Patients who are happy to be “wired up” to the “VAC-pac” in the immediate postoperative period can become frustrated by the restrictions imposed by the equipment when they wish to increase their level of activity and irritated by the various noises it makes.

*there are some patients... maybe quite elderly and frail and have had minimal education about how to use the pump...they haven't got a clue and are quite frightened of that pump, particularly when it alarms and it's beeping at 3 in the morning...*

(TVN1)

*They're really happy when they come home because the VAC is doing the job and it's got them home, but give them 2 to 3 weeks as their mobility improves and general health, they start to do other things it becomes a bit of a nuisance...they're always carrying this pump around...*

(TVN1)

## 5 | DISCUSSION

The main types of open surgical wounds managed by surgeons and nurses were open abdominal cavity wounds (laparostomy and dehiscence); wounds relating to treatment for pilonidal sinus; large, open wounds on the feet of patients with diabetes; and axilla and groin wounds. The most favoured treatment option by doctors and nurses for these types of open cavity wounds was NPWT, due to the way the dressing “seals in” the wound, containing exudate and giving the sense of reducing the likelihood of infection. Doctors and nurses also perceived that NPWT increased the rate of healing of the wounds; however, the lack of good research evidence to support the use of NPWT was mentioned by four of the five surgeon respondents, particularly in relation to cost-effectiveness. Yet this was not perceived as particularly problematic when weighed against personal positive experiences of NPWT, its increasing use in surgical practice and perceived benefits for patients. Surgeons attributed perceived cost-effectiveness of NPWT to their experiences of perceived earlier discharge of patients from hospital than can be achieved with use of conventional dressings, perceived reduction in the need for dressing changes by community-based nurses, resulting in decreased workload and perceived accrual of savings to the NHS, and patients being able to return to paid employment more quickly. Surgeons did not refer to the varying levels of expertise or the need for widespread training amongst community nurses in the application of NPWT that were highlighted as problematic by tissue viability nurses. A major drawback to use of NPWT (cited mainly by surgeons) was a perceived potential to cause intestinal fistulae when used in abdominal cavity wounds, for example, following laparostomy, where the gut and other intraperitoneal organs may be exposed. Some nurse participants expressed reservations concerning use of foam rather than gauze in the application of NPWT; gauze was viewed as less likely to cause pain to patients and more conducive to healing. Nurses and surgeons shared the view that NPWT is not a suitable treatment for the very frail (who could find the equipment difficult to manage) and/or for patients with cognitive impairment.

Evidence to support the widespread, routine use of NPWT for the treatment of open surgical wounds is currently lacking (Dumville et al., 2015), and there is considerable disagreement over whether it offers significant clinical benefit or is cost-effective. Early research by Argenta (Argenta & Morykwas, 1997) supporting the use of NPWT (mentioned by a study participant) was a case series of 300 patients with chronic and acute wounds, of which most were reported to respond positively to NPWT. This research, which was noncomparative, was contemporaneous with additional research

published by Argenta and colleagues in the same year reporting data on the use of NPWT animals (swine models) (Morykwas, Argenta, Shelton-Brown, & McGuirt, 1997).

Barker and Carlson (2011) have suggested that “*investment in the commercial development and market application of TNP (topical negative pressure/negative pressure wound therapy) seems to have considerably outstripped investment in the understanding of the basic science which underpins its potential efficacy, or robust assessment of its effectiveness in clinical trials*”. In our study, we were struck by clinicians’ own inferences regarding the cost-effectiveness of NPWT based on perceived shorter length of hospital stay and more rapid healing when used to treat open surgical wounds. These strong beliefs are not supported by hard research evidence; a systematic review published around the time of these interviews identified only two studies involving 69 participants in total and concluded an absence of evidence for NPWT in the treatment of open surgical wounds (Dumville et al., 2015). Dumville et al. (2015) have highlighted the need for more robust evidence to support increasing use of NPWT, based on randomised controlled trials that are adequately powered to detect treatment effects of a specified size (if they exist), and where sample size calculations have been carried out to estimate the number of people that should be recruited to a trial. Furthermore, trial follow-up needs to be sufficiently long to allow important outcome events, such as complete wound healing, to occur. The two trials included in Dumville et al.’s (2015) review were small, and the follow-up period of the study was uncertain, resulting in a limited evidence base, with further problems in quality caused by the reporting of limited outcomes. There is now a large National Institute of Health Research-funded trial underway (currently recruiting participants) designed to provide rigorous data on the clinical and cost-effectiveness of NPWT as a treatment for open surgical wounds (<https://www.journalslibrary.nihr.ac.uk/prgrammes/hta/174294/#/>). In the meantime, the National Institute of Health Care and Excellence (NICE, 2013) has issued interventional procedures guidance on NPWT as a management option for the open abdomen (where the gut and intraperitoneal organs are exposed), stating that current evidence concerning the use of NPWT for management of the open abdomen is sufficient to support its use, while pointing to the need for further research, specifically in relation to efficacy outcomes such as impact on wound care and healing rates and duration of hospital stay.

Surgeons interviewed for our study suggested that patient acceptability of NPWT is high, due to reduced requirement for dressing changes, and because it may allow patients to be more physically and socially active. However, nurses mentioned patients feeling that attachment to NPWT restricted their movement and activities and its bleeping noise caused sleep disturbance. Specialist tissue viability nurses highlighted problems relating to the difficulty of removing the foam component of NPWT because granulation tissue had anchored it to the wound, noting that this could be painful for patients, a problem highlighted elsewhere (Upton & Andrews, 2015; Vuolo, 2009). They also referred to a general lack of training amongst community nurses in the application of NPWT. These study findings reflect results from a review of 25 studies relating to patients’ experiences of

having NPWT (Upton, Stephens, & Andrews, 2013) that indicate that certain aspects of NPWT may impact negatively on patients’ well-being. The authors of the review report that the type of dressing used during treatment (foam or gauze) can have a significant effect on patients’ experiences of pain, and that patients may suffer raised anxiety, due to patient and nurses’ unfamiliarity with the equipment (Upton et al., 2013). Findings from our interview study with 20 patients (McCaughan et al., 2018) exploring patient perspectives of living with an open surgical wound, align with these results. A majority (11/20) of the patients we interviewed indicated that dressing changes were painful when sponge or foam was used, and exhibited anxiety about possible introduction of infection if district nurses seemed uncertain of how to apply NPWT. Patients in our study also reported being disinclined to mobilise outside the home with NPWT in situ, because the equipment is cumbersome, making it difficult to move around, and/or because they felt embarrassed due to its appearance, perceived associated smell or associated noise from the alarm. Janssen et al.’s review study (2016) also identified increased patient anxiety during the early stage of treatment with NPWT, attributed to nonportability of the device.

Surgeons displayed varying levels of knowledge relating to the plethora of wound care products and dressings available on the market and suggested that different wound dressings come into and go out of “fashion,” commenting that nurses have greater knowledge of benefits of specific wound products. Nurses (and two surgeons) cited Acquacel as a preferred dressing for open surgical wounds, as it is highly absorbent and can be left in place for up to seven days, thus requiring fewer dressing changes than some alternative products. However, there appeared to be a lack of consistency concerning selection of wound products for open surgical wounds amongst participants in our study, which is not surprising, as recent guidance from the National Institute for Health and Care Excellence (<https://www.nice.org.uk/advice/esmpb2/chapter/Key-points-from-the-evidence>) highlights the lack of evidence concerning the effects of dressings in healing of chronic wounds, and emphasises the need for further research to inform clinical practice. Currently, we know little about the clinical decision-making of nurses and surgeons regarding selection of available wound products, for primary or more complex wounds (Rooshenas, 2016), and our study findings shed some light on this under-researched area of clinical practice.

## 5.1 | Study strengths and limitations

As far as we are aware, this is the first study specifically designed to investigate, in parallel, surgeons’ and nurses’ views about the management and treatment of open surgical wounds healing by secondary intention. While the data collection took place in 2012, we have been unable to identify any similar study of health professionals’ perspectives, nor has there been any randomised controlled trial of NPWT in management of open surgical wounds since our data were collected, although authors here are involved in a current trial which is still in the recruitment phase. We purposively selected clinicians

working in different settings and specialities to investigate a range of views and approaches to the management of open surgical wounds in different patient populations. We regarded the clinicians comprising the study sample as “key informants” due to their close involvement in the day-to-day, “hands-on” care delivery to patients with open surgical wounds, well-positioned to identify and discuss relevant management and treatment issues. The number (12) of included clinicians was small, but not atypical of qualitative, descriptive studies, which rely on the quality of the data collected for validity, rather than the number of included participants (Kim, Sefcik, & Bradway, 2017). Particularity, rather than generalisability, is recognised as the hallmark of good qualitative research (Creswell, 2009), and our detailed findings help elucidate an important area of clinical practice almost wholly devoid of investigation. Nonetheless, our study was limited in various respects. The sample size was small and heterogeneous (surgeons practising in different fields and nurses working in a range of settings), and we recognise that the participants’ views reported here may not be reflective of the broader population of clinicians who manage open surgical wounds. Moreover, our study was confined to two sites. Further research is merited, with larger groups of clinicians, working in different service configurations and locations.

## 6 | CONCLUSIONS

Clinicians in our study favoured the use of NPWT and viewed it as a cost-effective option for the management and treatment of open surgical wounds, except for patients for whom intestinal fistula might be a risk, and patients who might find the equipment difficult to manage, due to frailty or cognitive impairment. Study participants reported increasing use of NPWT across different patient populations, with different types of open surgical wounds, based on clinicians’ own experiences and recommendations from commercial companies.

Despite its increasingly widespread use, evidence to support the cost-effectiveness of NPWT is currently lacking for open surgical wounds (Dumville et al., 2015). Research evidence for other wound types is varied and it is not clear whether effects of NPWT are modified by wound type. A recent review (Iheozor-Ejiofor et al., 2018) of NPWT as a treatment for open trauma wounds concluded that there was moderate quality evidence NPWT was not a cost-effective treatment for open fracture wounds (data from one trial of 460 participants). A review of NPWT for the treatment of closed surgical wounds concluded it is uncertain whether use of NPWT compared with other dressings reduces or increases the incidence of important outcomes (Webster et al., 2019).

Findings from our study highlight the importance of full, independent appraisal of NPWT, in hospital and community settings, in the form of large randomised controlled trials incorporating full economic evaluation. Results from rigorous studies, including systematic reviews (NICE, 2016; Wynn & Freeman, 2019; Chetter et al., *In press*), also indicate that there is insufficient good quality evidence

to assist clinicians in making choices between different types of dressings for use in the management and treatment of open surgical wounds and further research is required.

## 7 | RELEVANCE FOR CLINICAL PRACTICE

Making an informed decision concerning selection of the “best” dressing for open surgical wounds is hampered by the lack of independent, robust evidence regarding cost-effectiveness of the many wound care products on the market (Dumville et al., 2015; Norman et al., 2016; Vermeulen et al., 2004). Consequently, clinicians rely on experience, recommendations from local wound care formularies and protocols, and patient acceptability to inform their decision-making. Until further evidence becomes available, this approach, alongside consideration of costs, appears to be a reasonable strategy.

### ACKNOWLEDGEMENTS

Special thanks are due to all the participants who have taken part in an interview for this study. We also wish to thank Nikki Stubbs and Margaret Fletcher for assisting us in introducing the study to relevant members of nursing staff in each of the study sites.

### CONFLICT OF INTEREST

The authors declare no conflict of interest.

### AUTHOR CONTRIBUTIONS

NC, IC and JD conceived the idea and design for the study; DM and LS interviewed the surgeons and nurses and were responsible for data analysis. DM created the original draft of the manuscript. All authors contributed to the interpretation of study findings, critical revision of the manuscript and final approval of the manuscript.

### ETHICAL APPROVAL

The study received research ethics approval via the Integrated Research Application System (IRAS), UK REC reference: 11/YH/0313.

### DISCLAIMER

This project was funded by the National Institute for Health Research Programme Grants for Applied Research (PGfAR) Project number RP-PG-0609-10171. This paper presents independent research funded by the National Institute for Health Research (NIHR). The views expressed are those of the authors and not necessarily those of the NHS, the NIHR or the Department of Health.

### DATA SHARING STATEMENT

The data set is not available.

### PROVENANCE AND PEER REVIEW

Not commissioned; externally peer-reviewed.

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## SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

**How to cite this article:** McCaughan D, Sheard L, Cullum N, Dumville J, Chetter I. Nurses' and surgeons' views and experiences of surgical wounds healing by secondary intention: A qualitative study. *J Clin Nurs*. 2020;00:1-15. <https://doi.org/10.1111/jocn.15279>