Pre-operative and post-operative recommendations to surgical wound care interventions: A systematic meta-review of Cochrane reviews

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Abstract

Background: The increasing numbers of surgeries involving high risk, multi-morbid patients, coupled with inconsistencies in the practice of perioperative surgical wound care, increases patients' risk of surgical site infection and other wound complications.

Objectives: To synthesise and evaluate the recommendations for nursing practice and research from published systematic reviews in the Cochrane Library on nurse-led pre-operative prophylaxis and post-operative surgical wound care interventions used or initiated by nurses.

Design: Meta-review, guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.

Data sources: The Cochrane Library database.

Review methods: All Cochrane Systematic Reviews were eligible. Two reviewers independently selected the reviews and extracted data. One reviewer appraised the methodological quality of the included reviews using A MeaSurement Tool to Assess Systematic Reviews 2 (AMSTAR 2) checklist. A second reviewer independently verified these appraisals. The review protocol was registered with the Prospective Register of Systematic Reviews.

Results: Twenty-two Cochrane reviews met the inclusion criteria. Of these, 11 reviews focused on pre-operative interventions to prevent infection, while 12 focused on post-operative interventions (one review assessed both pre-and post-operative interventions). Across all reviews, 14 (63.6%) made at least one recommendation to undertake a specific practice, while two reviews (9.1%) made at least one specific recommendation not to undertake a practice. In relation to recommendations for further research, insufficient sample size was the most predominant methodological issue (12/22) identified across reviews.

Conclusions: The limited number of recommendations for pre- and post-operative interventions reflects the paucity of high-quality evidence, suggesting a need for rigorous trials to address these evidence gaps in fundamentals of nursing care.

What is already known about the topic?

- Surgical wounds are the most common wounds managed in acute care settings.
- Surgical wound care is an interprofessional activity, although it is predominantly nurse-led.
- There is considerable variability in surgical wound care practice, which may reflect overuse of ineffective care, underuse of effective care or uncertainty as to what constitutes appropriate care.

What this paper adds

- The quality of the primary studies included in Cochrane Reviews may determine the level to which clinicians are able, or feel compelled, to implement reviewers' recommendations in clinical practice.
- Clinical recommendations made in pre- and post-operative surgical wound management are weak or conditional because of methodological limitations and gaps in the current evidence base.
- Analysis of design and methodological rigour of included reviews identified the need for larger sample sizes, longer follow-up periods and inclusion of economic evaluations.

Introduction

Worldwide, an estimated 4511 operations per 100 000 population occur annually, equating to one surgical procedure each year for every 22 people[1]. Surgical wounds are the most common wounds managed in acute care settings and are associated with a variety of complications such as bleeding and dehiscence. However surgical site infections are the most common complication – and they are also the most preventable hospital acquired infection[2]. Internationally, surgical site infection rates are estimated to range from 1.9 per cent[3] to 40 per cent of surgeries[4]. One in four patients develop post-operative complications within 14 days of hospital discharge[5]. Consequently, current estimates suggest surgical wound complications account for almost 4 per cent of total health care system costs, and that proportion is rising. One case of surgical site infection can cost up to $30 000 depending on its severity[6].

In acute care settings, there is considerable variability in surgical wound care, reflecting overuse of unhelpful and ineffective care, underuse of effective care, or clinician uncertainty as to what constitutes appropriate care. Inconsistent practices often arise due to conflicting research evidence and variations in clinician preferences, which compromise attempts to limit or reduce iatrogenic harm and patients' risk of surgical site infection and other wound complications[7]. Although there are many surgical site infection prevention clinical practice guidelines, they are of variable quality and differ in their recommendations[8]. Further, the plethora of wound care products and aggressive marketing strategies in the absence of strong supporting evidence accentuates the complexities bedside nurses face when attempting to use an evidence-based approach[9]. The routine use of ineffective and often expensive wound care products and/or inappropriate use of effective products is not uncommon[9,10].

While surgical wound care involves interprofessional teams, registered nurses often lead these teams and frequently make nursing decisions, or recommendations to other health professionals, regarding various interventions for managing surgical wounds. High-quality systematic reviews of the literature, such as Cochrane Reviews, provide evidence syntheses upon which to base these decisions. Cochrane Reviews follow a stringent, peer-reviewed methodology that ensures all relevant studies are retrieved, are appraised for risk of bias, and their findings synthesised with the aim of generating and grading recommendations that guide both current practice and future research. Additionally, we have followed a similar process in focusing on only Cochrane Reviews (for the reason already stated) as have a previous group who undertook a meta-review of wound care five years ago[11].

This meta-review aimed to synthesise and evaluate the recommendations for practice and research contained within published Cochrane Systematic Reviews relating to pre-operative and post-operative surgical wound care interventions for preventing surgical site infection that were within the scope of nursing practice.

Materials and methods

Design

A meta-review of systematic reviews was undertaken in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines[12] and quality of individual reviews was assessed using A MeaSurement Tool to Assess Systematic Reviews 2 (AMSTAR 2) checklist[13]. The review protocol was registered with the Prospective Register of Systematic Reviews (number withheld for blinded review).

Inclusion/exclusion criteria

The setting (S), population (P), intervention (I), comparison (C), and evaluation (E) framework[14] was used to guide inclusion criteria, and report review characteristics.

Setting: The setting for this meta-review was any care environment including hospital, home, residential aged care or long-term care.

Population: Authors focussed on Cochrane reviews that included patients with a surgical wound, defined by the World Health Organization as 'a wound created when an incision is made with a scalpel or other sharp cutting device and then closed in the operating room by suture, staple, adhesive tape, or glue and resulting in close approximation to the skin edges'[15 p.10]. As such, episiotomies and full thickness skin grafts were included as types of surgical wounds. For reviews that examined multiple wound types including chronic wounds (e.g. venous, arterial or diabetic ulcers), only those studies or data relating to surgical wounds were included. Reviews which examined wounds outside the World Health Organization definition of a surgical wound were excluded.

Intervention: Reviews were required to examine nursing interventions for surgical wound care, defined as pre- or post-operative interventions for surgical wounds that may be implemented by registered nurses or interventions that registered nurses may recommend to other health professionals to implement in any care setting. Thus, interventions included but were not limited to, skin preparation, dressing removal, negative pressure therapy devices, debridement and use of topical agents, e.g. silver or aloe vera, and use of topical antibiotics and antiseptics. Reviews could comprise individual studies with randomised and/or non-randomised designs.

Reviews were excluded if they focused only on interventions provided by other health professionals such as surgeons or interventions for which nurses cannot make recommendations. These comprised interventions performed during the intra-operative period, (e.g. surgery), electromagnetic therapy or medication prescriptions.

Comparator: There were no restrictions on the comparators used, and comparators were as defined by review authors.

Evaluation: This review assessed specific recommendations made as described in the 'implications for practice' and 'implications for research' sections of the reviews and within the abstract. Practice recommendations were categorised according to:

a) the level of certainty of the evidence underpinning that particular recommendation which, in some reviews, was determined using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) criteria[16] of risk of bias, precision, indirectness, inconsistency, and selective reporting

b) how strong or unambiguous the recommendation was in regards to undertaking, or not undertaking, a specific practice.

Recommendations for research were grouped into three categories (e.g. further/better quality research needed) and methodological issues included ten categories (e.g. larger samples, greater statistical power, longer follow-up periods). Pre- and post-operative research outcomes from each review were classified based on 16 categories (e.g. cost, different setting/population, quality of life).

Search strategy

There were no date restrictions. A search of the Cochrane Library website (www.cochranelibrary.com/search) was conducted on 1 November 2018 for all published Cochrane reviews. The word 'wound' was the search term used in titles, abstract or keywords and these reviews screened. In the searches, only the word 'wound' was used to ensure that any relevant reviews were not missed. Thus, more time was allocated to screening more reviews.

Review section

Retrieved abstracts and titles were exported to an Endnote library for screening, with full-text articles obtained in cases requiring further information to enable screening. Two authors (WC, CW) independently screened all reviews to determine which should be selected based on inclusion and exclusion criteria. Instances of disagreement between the two authors regarding review inclusion were resolved by discussion and consensus.

Data extraction

Data extraction was conducted on each review independently by pairs of two authors (BG, RW, EM, ZM, AE, EH, CW) and adjudicated by a third (WC) if required. Data extraction included the following information (where available): source (author, year, reference, number of pages in full review and reference list), sample size (number of studies and participants identified), interventions and their comparators, outcomes, risk of bias (i.e. randomisation, allocation concealment, blinding, loss to follow up) and/or certainty of the body of evidence (using GRADE criteria[16]), recommendations for practice,

and implications for research. The extracted data was checked between reviewers and discrepancies resolved through discussion.

A standardised structured data extraction form was developed by the authors, with two reviewers piloting this data extraction form on two reviews, which led to further refinements. To minimise potential for conflicts of interest in the review process, authors of this meta review who were also co-authors of several included Cochrane reviews were not involved in reviewing the reviews that they co-authored. Authors who undertook data extraction underwent training and extracted data from two reviews each, with further training planned if discrepancies were seen, but there were none. As Cochrane reviews are presented in a 'standard' format, a data dictionary detailing where in each review the data was to be exacted from was also developed and used to ensure consistency in data extraction.

Data was also extracted on the risk of bias assessments made by the review authors on each study within their review. Notations were also made of reviews published before and after the Cochrane Library adopted the GRADE system of assessing certainty of evidence and strength of recommendations[16]. Reviews preceding GRADE criteria used risk of bias tables only, while those following both risk of bias tables and GRADE criteria, with relevant information extracted for both types of review. No attempt was made to re-appraise the reviews regarding risk of bias or GRADE criteria, with the original authors' ratings being accepted as valid.

Quality assessment

The methodological quality of the reviews was assessed using a validated 16-item measurement tool: AMSTAR 2 checklist[13]. The responses to the checklist items were scaled as 'fully performed', 'partially performed' or 'not at all performed' and 'yes' or 'no' as to whether data were pooled for meta-analysis. The AMSTAR 2 checklist identifies critical and non-critical domains that must be met in a review, as these affect the validity of the conclusions. The creators of the tool stress that items should not be summed; rather appraisers should consider the overall quality relative to 'critical domains' (items 2, 4, 7, 9, 11, 13 and 15) and 'non-critical weaknesses' (items 1, 3, 5, 6, 8, 10, 12, 14, 16)[13]. The overall rating of confidence in the quality of reviews is based on 'high' (no or one non-critical weakness), 'moderate' (more than one non-critical weakness), 'low' (one critical flaw with or without non-critical weaknesses) and 'critically low' (more than one critical flaw with or without non-critical weaknesses). For this meta-review, two appraisers (EH, CW) independently assessed a subsample of ten (45.5%) reviews and achieved good agreement (at least 80% as recommended by tool developers[13]). Then one appraiser (EH) completed the rest of the assessments, with another author (WC, BG) contacted in instances where EH was uncertain. Any disagreements were resolved through discussion and, when needed, final adjudication by a third reviewer (WC).

Data synthesis

Recommendations for practice and research were synthesised in narrative form, with evidence tables provided which contained quantitative effect estimates underpinning the recommendations, where available. Recommendations were categorised as being either 'specific' or 'general'. Specific recommendations included interventions that directly related to wound care practice and/or management, whereas general recommendations were considered as applicable to any areas of clinical practice, such as cost issues, patient condition. Content analysis of research recommendations using both inductive and deductive techniques was undertaken, and results presented in tabular format for both pre-operative and post-operative surgical wound interventions. This content analysis was directed by the following questions:

- Are practice and/or research recommendations made? (no/yes)
- What are the practice and/or research recommendations?
- How many practice recommendations are made to undertake a practice (i.e. to do something)?
- How many recommendations are made to not undertake (or stop) a practice (i.e. to not do something)?
- What is the certainty or quality of the body of evidence for each recommendation?

Results

Identification and selection of reviews

Figure 1 displays the PRISMA flow chart of Cochrane reviews used to identify and select reviews for inclusion. Our search identified 408 records, of which 386 were excluded after screening titles and abstracts, and a further four excluded after reading full-text articles, leaving 22 reviews that were included for analysis based on selection criteria. All reviews were published between July 2006 and October 2018. Of the 22 included reviews, one review[17] assessed both pre-operative and post-operative interventions.

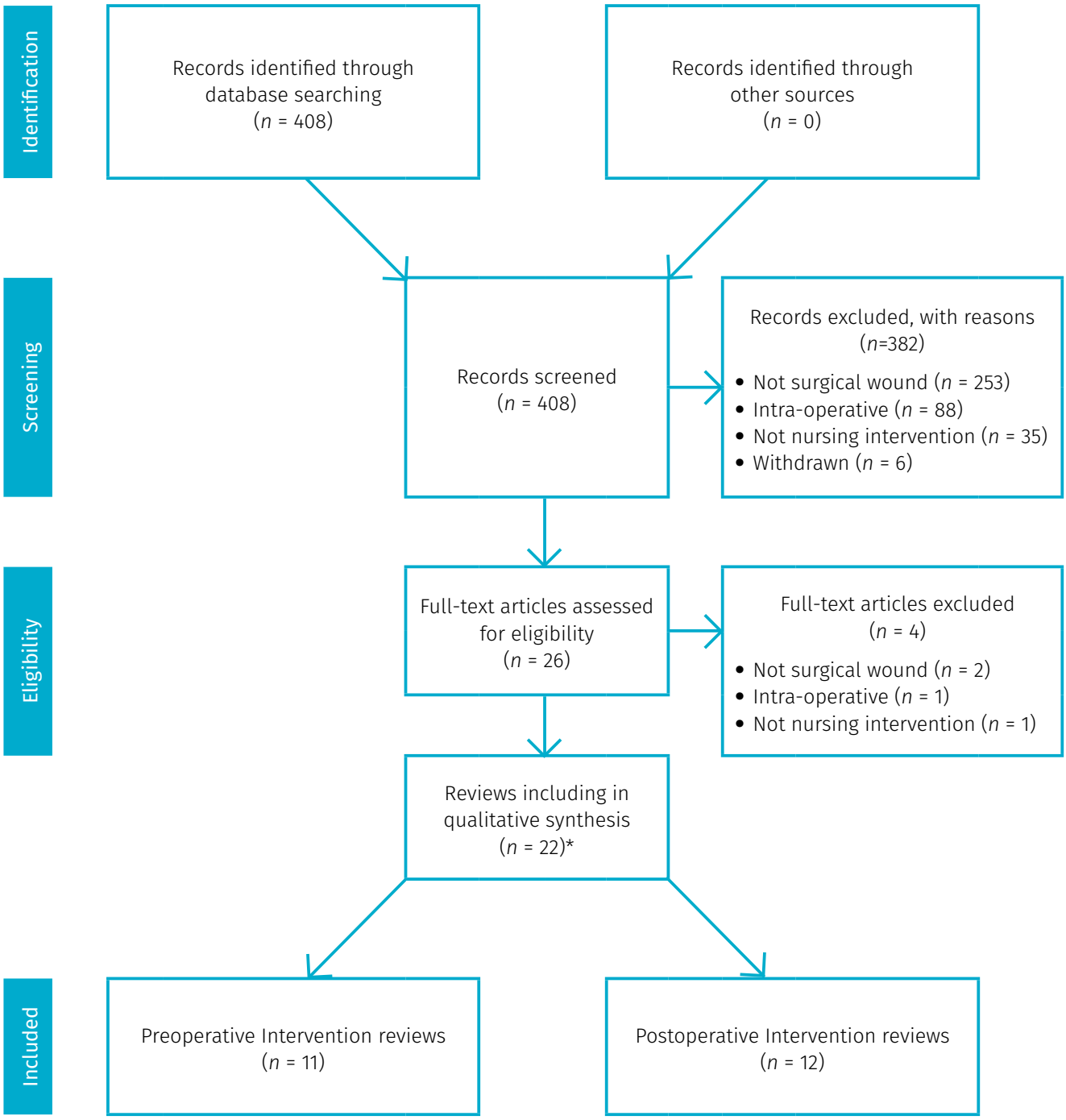

Figure 1: Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) flow chart

* One review assessed both pre-operative and post-operative interventions for surgical wounds.

Characteristics of the included reviews

Study characteristics relative to pre-operative and post-operative reviews respectively are provided in the supplemental material. Of 22 included reviews, 11 reviews focused on pre-operative interventions and 12 focused on post-operative interventions, with one[17] focusing on both pre- and post-operative interventions. There were 183 primary studies on surgical wounds from 33 countries across the included reviews. The top three countries where the primary studies were conducted were the United States (n = 54), the United Kingdom (n = 32) and Denmark (n = 10). Three reviews included studies that were multinational[18–20].

Twelve (54.5%) reviews were published after 2014 and reported the additional GRADE criteria, and six (27.3%)[17,21–25] were published by authors who were not members of the Cochrane Wounds group. Sixteen (72.7%) reviews comprised solely randomised controlled trials, while five (22.7%) included both randomised and quasi-randomised control trials. A single review had no studies[24] although it met the inclusion criteria and represented a gap in knowledge relative to education as a pre-operative intervention.

Findings of the included systematic reviews

Across all reviews, review authors made eight specific 'to do' recommendations and two specific 'not to do' recommendations. Table 1 details the recommendations for clinical practice across the pre-operative and post-operative Cochrane Reviews. Of the 11 pre-operative reviews, five reviews made at least one specific 'to do' recommendation while one review made at least one 'do not do' recommendation. Of the 12 post-operative reviews, three made at least one specific recommendation to do something while one review made at least one specific recommendation not to do something. In all, eight specific recommendations were made to do something, and two specific recommendations were made not to do something. Across reviews, there were ten general recommendations, such as considering costs, patient preferences, relative benefits and potential harms.

Recommendations for research

The supplemental material shows the recommendations for future research in respect to methodological issues and recommendations in relation to other outcomes identified across reviews of pre-operative and post-operative surgical site infection prevention interventions respectively. In terms of pre-operative interventions, ten reviews recommended that further research was needed in gauging the certainty of effects of the interventions trialled, with five reviews concluding more rigorous research was needed in overcoming insufficient sample sizes (7/11), short follow up periods (3/11) and suboptimal compliance with the reporting standards of the CONsolidated Standards of Reporting Trials Statement (3/11). Topics cited as in need of more investigation included adverse events/effects (6/11) and new comparisons between different interventions (6/11).

Regarding reviews of post-operative surgical site infection prevention interventions, all included reviews recommended the need for further high-quality research (see supplemental material 3) in dealing with issues of insufficient sample sizes (6/12) and limitations in allocation concealment (6/12). Analyses of cost-effectiveness (9/12) and quality of life (7/12) were nominated as topics for future studies.

Quality of included reviews

The methodological quality of the reviews as determined by the AMSTAR 2 checklist is shown in the supplemental material. For reviews that did not include any identified studies or were not able to conduct a meta-analysis, some items were not able to be analysed. Therefore, one review could not assess items 8 and 11 to 15, while seven reviews could not assess items 11, 12 and 15. Across reviews, the percentage of all reviews meeting each criterion ranged from 57 to 100 per cent in regards to the denominator of assessable items. In all, 15 reviews were rated as 'high quality'[17–24,26–32], two as 'moderate quality'[34,35], four as 'low quality'[35–38] and one 'critically low quality'[25]. A single review[24] found no studies that met their eligibility criteria and so a term 'no studies identified' was used as some items could not be assessed.

Discussion

This meta-review of Cochrane reviews described pre- and post-operative surgical wound interventions within nurses' scope of practice and examined their methodological quality and synthesis of recommendations for practice and research. Undoubtedly, registered nurses' scope of practice varies across countries relative to what is considered extended practice (e.g. debridement, prescription of topical ointments). Therefore, the application of these recommendations may necessarily differ. Most recommendations for clinical practice were general rather than specific, e.g. within the context of cost[20,27,35], quality of the body of evidence[18,20,33,37,38], likelihood of harm[27,30,35], and/or patients' and clinicians'

Table 1: Clinical recommendations for pre-operative and post-operative surgical wound practice (n = 22)

	Area of surgical wound care practice	Specific 'to do' recommendations	Specific 'do not do' recommendations	General recommendations	Review reference
Pre-operative practices	Removal of nail polish and rings	1. Develop local policies based on expert opinion of clinicians.			Arrowsmith et al. (2001)
	Pre-operative skin antiseptics			1. Consider potential side effects of alternative skin preparation solutions. 2. Consider costs.	Dumville et al. (2015)
	Vaginal cleansing with antiseptic solution before caesarean section	2. Implement pre-operative vaginal cleansing with povidone-iodine or chlorhexidine before caesarean deliveries.			Haas et al. (2018)
	Nasal decontamination in *Staphylococcus aureus* carriers.			3. Consider potential side effects when choosing between alternatives. 4. Consider costs	Liu et al. (2017)
	Prevention of infection in arterial reconstruction	3. Use antibiotic prophylaxis using antibiotics that fight staphylococcal and Gram-negative bacteria.			Stewart et al. (2006)
	Pre-operative hair removal	4. If hair removal is needed, clip.			Tanner et al. (2011)
	Pre-operative shaving		1. Shaving should not be part of routine clinical practice.		Tanner et al. (2011)
	Pre-operative bathing or showering with skin antiseptics to prevent surgical site infection	5. Focus on interventions where effect is evident.			Webster and Osborne (2015)
Post-operative practices	Negative pressure wound therapy for skin grafts and surgical wounds healing by primary intention		1. Avoid using negative pressure wound therapy following orthopaedic surgery until safety in this population is established.	1. Consider patient preferences when choosing dressings. 2. Consider costs.	Webster et al. (2014)
	Dressings or surgical incisions	1. Use antibiotic prophylaxis.		3. Use existing evidence and guidelines, e.g., hand hygiene.	Dumville et al. (2016)
	Early versus delayed post-operative bathing or showering	2. Consider the quality of water. 3. Consider the type of wound (i.e., primary/secondary closure).			Toon et al. (2015)
	Water for wound cleansing			4. Consider relative benefits of cleansing clean surgical wounds. 5. Consider the patient's general condition, including comorbidities	Fernandez and Griffiths (2012)
	Pin site care for external bone fixators			6. Implement general strategies to reduce cross-infection.	Lethaby et al. (2013)

preferences[20]. Recommendations made by review authors to either stop, or not do something clearly focussed on reducing potential side effects or harm[20,37]. Our findings suggest that most clinical practice recommendations across reviews were tentative or conditional because of methodological limitations and gaps in the evidence base. Given these apparent high levels of uncertainty in wound care[8,9,26,20], the guidance given to clinicians is more general than specific.

Despite a strong desire to adopt evidence-based practice, many clinicians practice within the constraints of ongoing uncertainty, and base their clinical decision-making on intuition[39], personal experience, peer opinions, professional norms, and past teaching[9,40,41]. When confronted with a clinical conundrum, health professionals often make decisions founded on their internalised tacit guidelines and mental 'rules of thumb' (or heuristics)[39]. Although this approach may suffice for many decisions, intuitive decision-making is predisposed to various types of 'cognitive biases' that can distort the synthesis and accurate interpretation of information presented[39]. Cognitive biases such as 'attribution bias' (based on my clinical experience I believe this intervention is effective), 'impact bias' (this intervention is working well and the patient's wound seems to be improving) and 'ambiguity bias' (I am unsure about what to do so I will stick with what I know and what everyone else seems to do)[39] influence clinical decision-making in wound care. However, it is difficult to determine whether the clinical care delivered is low or high value when the evidence is so poor or non-existent. In the absence of high-quality evidence, there is a risk that what may eventually be shown to be ineffective or even harmful care is perpetuated over time. For instance, despite the very low certainty of evidence on the prophylactic use of negative pressure wound therapy in preventing surgical site infection, the use of these devices is increasing in surgical care because of clinicians' preferences and the prolific marketing by industry[9,20]. Therefore, there is a propensity to make clinical decisions based on limited/weak evidence, or on outdated evidence, which increases the risk that at least some of this care is likely to be of low value. Low value care is care that provides limited or no benefit, may cause patient harm, or may yield costs that are disproportionate to added benefits[7].

While all but one review[21] recommended that further trials be undertaken to expand the base of high quality evidence, what remains unclear is the extent to which some of the questions / topic areas highlighted in these reviews are most important to clinicians and consumers. For example, it is questionable whether more research would be of value in investigating removal of nail polish prior to surgery. Further, in surgical wound care and recovery, attention is now being focussed more on lifestyle interventions (e.g. nutrition, early post-operative mobilisation) in combination with other wound care interventions. Nonetheless, interventions such as nutrition have more upstream and diffuse impacts and are not the subject of these Cochrane Reviews which focus on 'just in time' prevention. In all reviews, authors recommended comparisons with multiple other interventions, not just one or two, to be included in the same trials. Mapping research questions against published systematic reviews may identify evidence-rich and evidence-poor areas of clinical practice which can help identify and prioritise directions and focus of future research. For example, one analysis demonstrated that over 50 per cent of published studies are designed without reference to existing systematic reviews of the evidence[42], contributing to wasted effort on researching practices for which the evidence is already well established. Compounding this problem are estimates of over 50 per cent of published research being seriously flawed in design or being unusable because of poor reporting, or both[43].

Limitations

We were selective in our approach and included only systematic reviews drawn from the Cochrane database because of their robust methodological approach. While we are aware of other systematic reviews in the area of wounds[44–46] we focused on Cochrane Reviews because of their explicit sections on implications for practice and research. However, the results of this review are inherently limited by not only the quality of the reviews, but also the quality of the evidence from the primary studies. Over the 12-year period these Cochrane reviews were published, methodological and reporting standards have improved. However, appraising the overall quality of the reviews using the AMSTAR 2 checklist has some limitations. First, the recommended scoring system marks reviews down where meta-analyses (Q11, 12 and 13) are not possible because of high heterogeneity among primary studies. Second, the tool does not assess the logic underpinning the choice of methods for conducting a particular review. Third, the tool does not specify which risk of bias instruments review authors should use to assess non-randomised trials and downgrades all such studies irrespective of differences in risk of bias.

Conclusions

The results of this meta-review suggest much uncertainty persists around the evidence to support many of the practices used in surgical wound care. To provide better health care, there is a compelling need for better evidence. Despite the availability of well-conducted systematic reviews, their contribution to clinical practice and research is ultimately determined by the quality of the primary studies. Clearly, there is a link between poor research and poor information, making clinical decision making difficult and perpetuating what may turn out in the future to be a significant burden of low-value care in surgical wound practice.

Conflict of interests

None.

Funding sources

This study was partly funded by the School of Nursing and Midwifery, Griffith University.

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