Skin status for predicting pressure ulcer development: A systematic review and meta-analyses

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ABSTRACT

Background: People with altered skin status are conventionally considered to have a higher risk of developing new ulcers. However, the evidence underpinning this potentially prognostic relationship is unclear.

Objectives: To systematically review the evidence for the prognostic association of skin status with pressure ulcer risk.

Methods: We performed a comprehensive electronic database search in February 2017 to identify longitudinal studies that considered skin status in multivariable analysis for predicting pressure ulcer risk in any population. Study selection was conducted by two reviewers independently. We collected data on the characteristics of studies, participants, skin status, and results of multivariable analyses of skin status–pressure ulcer incidence associations. We applied the Quality In Prognosis Studies tool to assess risk of bias. We conducted meta-analyses using STATA where data were available from multivariable analyses. We used the Grades of Recommendation Assessment, Development and Evaluation approach to assess the certainty of evidence generated from each meta-analysis.

Results: We included 41 studies (with 162,299 participants, and 7382 having new ulcers) that investigated 15 skin descriptors. Participants were predominantly hospitalised adults and long-term care residents (with a median age of 75.2 years). Studies had a median follow-up duration of 7.5 weeks. 61.0% (25/41) of studies were judged as being high risk of bias. 53.7% (22/41) of studies had small sample sizes. Subsequently, the certainty of evidence was rated as low or very low for all 13 meta-analyses that we conducted though all analyses showed statistically significant associations of specific skin descriptors–pressure ulcer incidence. People with non-blanchable erythema may have higher odds of developing pressure ulcers than those without (Odds Ratio 3.08, 95% Confidence Interval 2.26–4.20 if pressure ulcer preventive measures were not adjusted in multivariable analysis; 1.99, 1.76–2.25 if adjusted) (both low-certainty evidence). The evidence for other skin descriptors was judged as very low-certainty and their prognostic value is uncertain.

Conclusions: There is low-certainty evidence that people with non-blanchable erythema may be more likely to develop new pressure ulcers than those without non-blanchable erythema. The evidence for the prognostic effects of other skin descriptors (e.g., history of pressure ulcer) is of very low-certainty. The findings support regular skin assessment and preventive action being taken in the presence of non-blanchable erythema. Given the millions at risk of ulceration and the widely recommended use of skin status as part of risk assessment there is a need for more, high quality confirmatory studies.

What is already known about the topic?

- Skin assessments by eye and touch are routinely carried out for pressure ulcer prevention to check for abnormalities (e.g., non-blanchable erythema), and people with such skin abnormalities are often considered to be at a particularly high risk of developing new ulcers.
- Guidelines recommend that nurses should increase the provision of preventive interventions (e.g., specific support surfaces) in the presence of non-blanching erythema.

- Three previous systematic reviews summarising the evidence for skin status signalling increased pressure ulcer risk have methodological limitations (e.g., not appropriately assessing risk of bias in included studies).

What this paper adds

- This prognostic factor systematic review includes thirteen meta-analyses of data for corresponding skin status descriptors and identifies their prognostic value in pressure ulcer development.
- There is no high-certainty evidence that any of the 15 skin descriptors are strong predictors of the risk of new pressure ulcer development. People with non-blanchable erythema may be more likely to develop new pressure ulcers than those without however this evidence is low certainty.
- High-quality, confirmatory prognosis research and individual participant data meta-analysis are needed to improve the evidence base.

1. Introduction

Pressure ulcers (also known as pressure injuries, pressure sores, bedsores, and decubitus ulcers) are localised injuries to skin and/or underlying tissue, caused by pressure, shear or both (NPUAP/EPUAP/ PPPIA, 2014). Pressure ulcers represent a serious health burden, with a point prevalence of approximately 3.1 per 10,000 in the geographical population of the city of Leeds, United Kingdom (Cullum et al., 2016) whilst hospital prevalence estimates range from 470 to 3210 per 10,000 patients in the United Kingdom, United States and Canada (Kaltenthaler et al., 2001).

For people at pressure ulcer risk, guidelines recommend that care practitioners should carry out regular, comprehensive skin assessments to identify any abnormal changes in the appearance or texture of skin, in particular over bony prominences (National Institute for Health and Care Excellence (NICE, 2014). Possible abnormalities include changes of skin integrity (e.g., current pressure ulcers), colour changes (e.g., non-blanchable erythema), and/or variations in moisture (e.g., moist skin, oedematous or dry skin) (National Institute for Health and Care Excellence (NICE, 2014). People with such skin status are often regarded as having a particularly high risk of developing new ulcers (NPUAP/EPUAP/PPPIA, 2014) so monitoring for their presence is deemed important in developing individualised skin care planning. For example, guidelines recommend that when people have non-blanchable erythema care practitioners should start the provision of appropriate preventive interventions (e.g., specific support surfaces) to deter the progression of developing a severe pressure ulcer (Vanderwee et al., 2007).

Given the importance of skin assessment in pressure ulcer management it is crucial to investigate evidence on the predictive value of specific skin status descriptors. That is, the evidence on whether people with certain skin status have a higher risk of developing a new pressure ulcer than those without. Currently, three systematic reviews suggest that skin status (e.g., non-blanchable erythema) is significantly associated with pressure ulcer development in general populations (Coleman et al., 2013; Marin et al., 2013; Michel et al., 2012). However, none of these reviews followed the currently recommended methods for prognosis systematic reviews (Riley et al., 2007) and could be significantly improved by using more sensitive search strategies, using appropriate tools for risk of bias assessment, integrating bias considerations in the synthesis, and quantifying the strength of prognostic association of skin status.

2. Objectives

To assess the independent prognostic value of a variety of skin status descriptors in predicting pressure ulcer development.

3. Methods

This review was based on recent methods developments in the design and conduct of prognosis systematic reviews proposed by the Cochrane Prognosis Methods Group (Riley et al., 2007). It was registered with PROSPERO (CRD42016042140) and complies with the Meta-analyses Of Observational Studies in Epidemiology statement for its reporting (Stroup et al., 2000).

3.1. Eligibility criteria

We included longitudinal studies that considered skin status descriptors in multivariable analyses for predicting pressure ulcer risk in any population (Steyerberg et al., 2013). Eligible studies measured pressure ulcer incidence or the time to a new ulcer as outcomes, with individuals as the unit of analysis. We included studies irrespective of whether they reported pressure ulcer outcomes as: Grade 1 or above ulcer incidence; Grade 2 or above ulcer incidence or both. Where studies did report multiple incidence outcomes, sensitivity analysis was conducted (see below).

In terms of defining what counted as a skin status descriptor we considered three key categories: colour changes (e.g., non-blanchable erythema); variations in moisture (e.g., moist skin, dry skin); and changes of skin integrity (e.g., current pressure ulcers, previous pressure ulcers) (Coleman et al., 2013). However, we did not restrict study inclusion on specific skin statuses within these categories. Rather, we considered any skin status that was investigated in studies as eligible if it could be determined by eye and touch in practice. We included studies regardless of whether they targeted a specific skin status to evaluate its independent effect (confirmatory phase study), or aimed to explore a group of potential prognostic factors that included a specific skin status (exploratory phase study) (Hayden et al., 2008).

We excluded case-control studies, cross-sectional studies, case series, case reports, reviews, qualitative studies, comments, and animal studies (Steyerberg et al., 2013). We also excluded studies of participants undergoing flap coverage of pressure ulcers, as well as studies focusing on medical device-related ulcers.

3.2. Search strategy

We developed search strategies that combined the pressure ulcer terms used by Cochrane Wounds (McInnes et al., 2015) with published prognosis study search filters. Prognostic study search filters from Ingui and Rogers (2001) and Geersing et al. (2012) were used with pressure ulcer terms to search Ovid MEDLINE (1946 to 14 February 2017) (see Appendix 1 in Supplementary material). The prognosis study filter from Walker-Dilks et al. (2008) was used with pressure ulcer terms to search EBSCO CINAHL Plus (1937 to 14 February 2017). All these search strategies had been validated. There was no restriction on the basis of language or publication status.

We also searched ProQuest (14 February 2017) for relevant doctoral theses in English and Chinese using the filter detailed in Wilczynski and Haynes (2004). We checked the reference lists of eight relevant systematic reviews (Beeckman et al., 2014; Coleman et al., 2013; Gélis et al., 2009; Ham et al., 2014; Liu et al., 2012; Marin et al., 2013; Michel et al., 2012; Reenalda et al., 2009) and of the included studies for any potentially relevant entries. We also contacted the original investigators of the included studies for any relevant entries.

3.3. Study selection

One reviewer screened the titles and abstracts of all citations returned from the search. To support the second screening of the large number of records in a timely way, all citations were divided into six batches and each batch independently screened by a different second reviewer. Disagreements were resolved by discussion between the two