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Pressure injuries in people with darker skin tones: A Literature Review

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Literature Review

Pressure injuries in people with darker skin tones: A Literature Review

ABSTRACT

Aim: In this paper we aimed to explore the literature to ascertain what research evidence exists in relation to the identification of pressure injuries (PIs) in people with dark skin tones (DSTs).

Background: PI development has been widely researched and documented; however, much of this work does not address ethnicity or race, and assumes Caucasian-ness. Thus, the perceptions of people with DSTs and the influence of skin pigmentation on identification and management of PIs is under examined.

Design: Literature review.

Methods: A comprehensive electronic database search was undertaken of PubMed, Cumulative Index for Nursing and Allied Health Literature, Cochrane and British Nursing Index between 1990 – July 2016. Alongside the electronic data, journals, books, papers from conferences, relevant national and international organisations and reference lists were also used to help source key studies.

Results: A search of the literature revealed 11 relevant articles. The foci of studies included: risk of sustaining a PI based on skin tones; identification of PIs amongst people with DSTs; PI and place of care; and socio-economic impact on PI development. Overall, findings indicate that people with darker skin tones are more likely to develop higher stage pressure injuries. Reasons for this are not fully elucidated; however, it may be associated with current skin assessment protocols being less effective for people who have darker skin tones resulting in early damage arising from pressure not being recognised.

Conclusion: From the literature reviewed it can be seen that there is a lack of guidance and evidence, people with darker skin tones are more likely in comparison to people presenting as Caucasian to develop higher stage pressure injuries.

Relevance to clinical practice: The current literature suggests a need for researchers and clinicians to consider skin tone variances rather than ethnicity when exploring comprehensive skin assessment.

Keywords: Ethnicity, Inequalities in Health, Literature Review, Pressure Injury, Pressure Ulcer, Patient Safety

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

- This review's findings acknowledge that the identification of pressure damage in people with darker skin tones is mainly focused on ethnic background or race rather than skin tone variances. Ethnic background and race is an unreliable determinant of pressure injury risk, the use of skin tone as a differentiator of service user skin colour enables wide spectrum individualisation of care and prevents a categorisation approach.
- The findings of this review raise awareness of the importance of skin tone variances in comprehensive skin assessment.
- There is a need for researchers to consider skin tone variance when further developing pressure injury assessment strategies.

BACKGROUND

Pressure injuries (PIs) are generally considered to be a preventable and predictable form of harm (National Pressure Ulcer Advisory Panel, NPUAP 2016). For more than fifty years, PI risk has been at the forefront of nursing care delivery due to the impact of PIs upon patients' physical and mental wellbeing, as well as the financial consequences for organisations (Spilsbury *et al.* 2007, Dealey *et al.* 2012, Jackson *et al.* 2016;).

A PI (previously known as a pressure ulcer or bedsore) is localised injury to an area of skin and/or underlying tissue that is caused by pressure or pressure in combination with shear, often on a bony prominence or related to medical or other devices (NPUAP 2016). PIs are currently staged from 1-4 with four other categories known as unstageable, suspected deep pressure tissue injury, medical device related pressure injury and mucosal membrane pressure injury (NPUAP 2016). For the purpose of this literature review, and in line with NPUAP guidelines (2016), a stage 1 PI is defined as intact skin with a localised area of non-blanchable erythema, which may appear differently in darker skin tones (DSTs). A stage 2 PI has partial-thickness skin loss, whilst stage 3 and 4 have full-thickness skin loss (NPUAP 2016). Alongside the definition of PIs, it is important to acknowledge their causative factors. This differentiates PI from other wounds presenting on the sacrum, buttocks and perineum that are caused by moisture and defined as moisture lesions (Guy 2012, Beeckman *et al.* 2014, Linthwaite & Bethell 2016).

The terms and stages used within PI management have been subject to amendments over the years to reflect current practice and epidemiological studies (Harrison *et al.* 2013). One important revision in the definition of a stage 1 PI, is the acknowledgement that skin tone variance may affect presentation (NPUAP 2008). Grimes (2009) confirmed that DSTs rarely show the blanching response, and erythema may be hard to detect. Moreover, skin irritation to people with DSTs may cause hyperpigmentation (increased pigmentation) or hypopigmentation (reduced pigmentation), with no redness visible. People with DSTs are also more prone to keloidal scarring, ingrown hairs, and hyperpigmentation (Nijhawan & Alexis 2011). Thus, skin tone variance is not as simple as 'black' and 'white'. Variations in skin tones are not and should not be affiliated to a different skin type however it is important to recognise that dissimilarities exist.

Nurses carry out skin assessments numerous times a day to prevent and manage PIs, and therefore come across variations of natural skin colour amongst patients. For provision of clinically competent and individualised care clinicians need to take note of the skin tone variations and demonstrate skin tone awareness to avoid health care disparity between groups (Gee & Ford 2011). Current literature has started to address the gap of skin tone variance in skin assessments acknowledging that ethnicity cannot be used as a proxy for skin tone (Pichon *et al.* 2010, Everett *et al.* 2012, McCreath *et al.* 2016). Yet, the literature available on skin tone variances appears to offer little on the identification of PIs amongst people with DSTs and mainly focuses on ethnicity or racial descriptors.

AIM

In this paper we aimed to explore the literature to ascertain what research evidence exists in relation to the identification of PIs in people with DSTs.

OBJECTIVES

- To examine whether people with DSTs are more likely to have PIs.
- To examine whether people with DSTs are more likely to have higher staged PIs.
- To explore some of the differences between the cause for PIs amongst people with DSTs and those with lighter skin tones.

METHODS

A comprehensive search of the electronic databases of PubMed, Cumulative Index to Nursing and Allied Health Literature (CINAHL) and British Nursing Index (BNI) between 1990 – July 2016 was conducted to search for relevant data-based, peer-reviewed literature. The timeframe was set to capture activity following the 1989 NPUAP goal, of reducing the incidence of pressure ulcers by 50% by the year 2000 (Cuddigan *et al.* 2001). Specific subject headings under which searches were made included: 'pressure injury', 'pressure ulcer', 'deep tissue injury', 'bed sore', 'decubitus', 'ethnicity', 'race', 'skin tone' and 'skin colour'. These terms and the search procedures were audited by a health librarian. Alongside the electronic data, journals, books, papers from conferences, relevant national and international organisations and reference lists were also hand searched to help source key studies. The inclusion criterion for this literature review was that all articles need to be based on original empirical research relating to adults, in the English language with at least one element of comparative data.

SEARCH OUTCOMES

A total of 596 papers were initially identified from the combined search strategy, 182 duplicated articles across the databases were discarded. Of the articles remaining many were rejected as they were of poor quality, reported prevention strategies or the development of tools resulting in 436 being screened. Following exclusions, eleven studies remained, all of which were quantitative studies (See figure 1).

Data Extraction

After reviewing the 11 articles using component ratings (National Collaborating Centre for methods and Tools 2008) data extraction took place with relevant information inserted into Table 1.

RESULTS

Four foci were identified: (i) risk of sustaining a PI based on skin tones; (ii) identification of PIs amongst people with DSTs; (iii) PI and place of care; and (iv) socio-economic impact on PI development. The studies included have interchangeably used category, grading or staging when assessing severity of a PI; through the presentation of results and discussion the term staging will be used, as this is the term recommended by the NPUAP (2016).

Risk of sustaining a PI based on skin tones

NPUAP guidelines reflect changes based on the production of new evidence; the stages that have been referred to in some studies (Bergstrom *et al.* 1996, Baumgarten *et al.* 2004) are up to date for the study, but are not contemporaneous overall. Three studies (Bergstrom *et al.* 1996, Baumgarten *et al.* 2004, Cai *et al.* 2010) made no acknowledgement of how PIs, particularly at stage 1, presented in people with DSTs. Classification of colour or ethnicity into categories within all the studies reviewed was dependent on observer-reported race-

In Howard & Taylor's (2009) study which analysed Minimum Data Sets (MDSs) in the Atlanta Region from 1999-2002, stage 2 PIs which are visual breaks in the skin (NPUAP, 2016) were the most common stage on admission, occurring at a rate of 2.6% in the overall study sample. A consistent trend found across a number of the studies reviewed showed that people with DSTs had the highest risk of higher stages of PI (Baumgarten *et al.* 2004, Vanglider *et al.* 2008, Gerado *et al.* 2009, Fogerty *et al.* 2009, Cai *et al.* 2010, Li *et al.* 2011, Harms *et al.*, 2014, Ahn *et al.* 2016). Findings from one study suggested that people who had skin classified as medium or dark were more likely to develop PIs with a visible break in their skin (Vanglider *et al.* 2008). This statement is reinforced by Harms *et al.*'s (2014) study where people admitted to nursing homes who had been categorised as black had a 1.7 higher chance of developing PIs than people categorised as white. While PI risk amongst people with DSTs is high, the stage of PI varied; as drawing on further from Harms *et al.*'s (2014) work, people categorised as 'black newly admitted to nursing homes' had the lowest prevalence of stage 1 PIs but the highest prevalence of stage 2 PIs amongst all racial and ethnic groups. This could infer that stage 1 PIs were not being detected meaning that appropriate nursing interventions to prevent early stage PIs developing into stage 2 were not able to be initiated. In the absence of high quality information pertaining specifically to PIs amongst people with DSTs it is difficult to make comparisons between studies.

Identification of PIs amongst people with DSTs

Despite there being four recognised stages of a PI, many of the studies focused on stage 2 or above and discounted stage 1 PIs as they were considered to be reversible as well as difficult to identify (Baumgarten *et al.* 2004, Gerardo *et al.* 2009, VanGlider *et al.* 2008, Li *et al.*, 2011, Ahn *et al.* 2016).

The studies presented within this literature review mostly look at PI identification and assessment within the one continent which directly relates to ethnic groups and skin types within that area. It is notable that both race and ethnicity cover a wide spectrum of groups. When considering the heterogeneity of skin tones internationally identifying people only by race can be challenging and may not provide enough detail, particularly in relation to skin assessment. Of the eleven studies included in this review five (Baumgarten *et al.* 2004, Fogerty *et al.* 2009, Howard & Taylor 2009, Cai *et al.* 2010, Li *et al.* 2011) referred to people as being either from a 'black' or 'white' race, with little indication of the involvement of people from other minority ethnic groups or mixed backgrounds. VanGlider *et al.* (2008) identified that skin tone may not be specifically linked to ethnic groups and people may instead be classified as being of dark, medium or of light skin. However, categorisation in the study by VanGlider *et al.* (2008) was subjective as the assessor made the distinction between the categories and inter-rater reliability was not addressed.

Prevalence and incidence rates of PIs have been presented differently across the articles reviewed. Five of the articles were presented as prevalence studies (VanGlider *et al.* 2008; Gerardo *et al.* 2009; Cai *et al.* 2010; Li *et al.* 2011; Harms *et al.* 2014;) and four were incidence studies (Bergstrom *et al.* 1996; Baumgarten *et al.* 2004; Howard & Taylor 2009). Both set of studies were spread across various time frames which often related to the collection of data from the MDS. One study using an online survey did explore PI prevalence across nine international settings and it was identified that between 1999 and 2005 prevalence remained at approximately 15% of the total sample however prevalence of PIs amongst people with DSTs was only presented between 2004 and 2005. Within this timeframe PIs was more visible amongst the higher stages of PIs in comparison to people with a light skin tone (VanGlider *et al.* 2008).

Risk factors vary widely between different groups of people as well as between countries. Estimated risk assessment scores for people categorised as either a white or black Caribbean were the same; however a confounder was that people categorised as Black other were on average younger (Anthony *et al.* 2002). Similarly, reporting North American findings, Baumgarten *et al.* (2004) identified that people from a black race were younger at admission and had more complex care

needs. According to Baumgarten *et al.* (2004), despite there being more care needs amongst black people there was no significant differences between people from a black or white race in the site or stage of PIs; however, the rate per person per year of PI development for people from a black race (0.56) was significantly higher ($P < .001$) than people from a white race (0.35). The multivariate analysis in Baumgarten *et al.* (2004) study reported that based on the Cox proportional hazards models the inclusion of a covariate (a person's body mass index, number of comorbid conditions, admission from hospital and diabetes) changed the hazard ratio for race by less than 10%, indicating race to be a significant factor on PI development. However, when age was taken into account within Anthony *et al.*'s (2002) study there was no statistical evidence to suggest people of Pakistani origin were more or less likely to develop a PI.

An association between under diagnosis and stage 1 PIs amongst people with DSTs was suggested in some studies (Bergstorm *et al.* 1996, Baumgarten *et al.* 2004, Howard & Taylor, 2009) and have as a result led to stage 1 PIs being excluded completely from these studies. Bergstorm *et al.* (1996) acknowledged that there are both functional and structural differences between races that would predispose people from a white race to develop PIs however the results from other studies in the review contradict this view. Contrary to the suggestion that people from a white race are at higher risk of all stage PIs, Harms *et al.* (2014) study found that all but stage 1 accounted for more PIs in people from a black racial background admitted to nursing homes. To further emphasise this point, whilst exploring nursing home residents who had been in a nursing home for more than 90 days it was identified that people categorised as Hispanic and non-Hispanic blacks (9.7% and 12.1% respectively) were more likely to have a stage 2-4 PI in comparison to people categorised as non-Hispanic whites who had 7.6% probability of a PI (Gerado *et al.* 2009).

VanGlider *et al.* (2008), Howard & Taylor (2009) and Li *et al.* (2011) established that residents from a white race or residents with a light skin tone had the highest rate of stage 1 PIs whilst residents from a black race or with DSTs had the highest rate of all other stages. Based on data gathered over three months following admission to a nursing home, Howard & Taylor (2009) established that AA residents experienced a higher incidence of risk at each stage except stage 1 PI development. The frequency of a stage 1 PI for AA residents was 0.6% compared to 0.1% for white residents, while a stage 4 PI in AA residents was 4.7% compared to 3.4% for white residents. According to Li *et al.*'s (2011) secondary analysis of data (2003-2008) there was an overall unadjusted racial difference of 5.4% between black and white race residents for developing a PI.

PIs and place of care

PIs for many years have been considered as a measure of care quality and despite being highly prevalent in hospitals they remain significantly higher in nursing homes and long term acute care facilities (VanGlider *et al.* 2008, Fogerty *et al.* 2009,). This finding can be supported by Howard & Taylor's (2009) study where a total of 3.6% of the nursing home resident sample developed a PI.

Quality indicator data of nursing homes can be interpreted negatively if risk adjustment procedures as well as application and analysis strategies of PIs measurement tools are not considered. The overall aim for care improvements identified within quality indicator data links to the overall reduction of PIs; they do not highlight the need to reduce widespread disparities amongst various groups, this could be an indication of why PI figures have not changed (Vanglider *et al.* 2008). Li *et al.* (2011) indicated that figures of PIs in nursing homes have decreased from 16.8% in 2003 to 14.6% in 2008; and the rate of PIs amongst people categorised as white reduced from 11.4% 2003 to 9.6% in 2008; however, authors of this study made no claims of generalisability as it was based on nursing homes certified by the Centers for Medicare and Medicaid Services in the US.

With most PIs being avoidable, links to quality of care in nursing homes are confirmed by national measurements and various government regulations within care facilities. Unfortunately, in most of the studies reviewed it is not distinguishable if residents had a PI prior to admission to the facility or if the PI were acquired once in the nursing home. Baumgarten *et al.* (2004) looked at residents newly admitted to nursing homes, the prevalence of PIs was reported to be between 10 to 33%; however, the sample only included people aged 65 years and older. Fogerty *et al.* (2009) identified that 1.43% out of a total of 6610787 patients over 18 were discharged from hospital with a PI. More in line with Baumgarten *et al.* (2004) results, Bergstrom *et al.*'s (1996) study reported 23.9% of newly admitted residents to nursing homes developed a PI and Harms *et al.* (2014) found a 14% overall prevalence of stage 2 to 4 PIs upon admission to a nursing home. At total sample level within Bergstorm *et al.*'s (1996) study it can be noted that people categorised as white had a higher incidence of PIs (15%) in comparison to people categorised as black (5%). However the number of people categorised as black from each individual care setting within the study is not clearly reported therefore generalisability is compromised. In contrast Harms *et al.* (2014) found that people categorised as black had the highest prevalence of stage 2 to 4 PIs (26%) and people categorised as white had the lowest (15%).

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These disparities have caused some authors to consider issues around equity in relation to care provision (Cai *et al.* 2010). Two studies (Gerado *et al.* 2009, Li *et al.* 2011) highlighted that disparities in PIs are largely a system problem and variance in occurrence of PIs is linked to the lack of quality assessments within service provision rather than a person's race. Gerado *et al.* (2009) identified that an older Hispanic person living in a nursing home with more Hispanic residents was more likely to develop a PI in comparison to a nursing home with more non-Hispanic white residents. In nursing homes with no Hispanic residents, the chance of developing a stage 2-4 PI was 5.63-7.07% (Gerado *et al.* 2009). In contrast, in a nursing home with $\geq 20\%$ Hispanic residents there was an 8.05-8.92% chance of developing a stage 2-4 PI (Gerado *et al.* 2009). The results presented were reinforced by the study carried out by Li *et al.* (2011) where nursing homes with the highest concentration of people categorised as black had at least 30% increased risk of developing a PI in comparison to areas with a small number of people from a black population group.

Socio-economic trends and PIs

Two studies (Fogerty *et al.* 2009, Cai *et al.* 2010) specifically reported on socio-economic impact compared to ethnic background. Unfortunately, due to the small sample size from different ethnic groups and data limited to nursing home populations, this component was difficult to explore and create comparisons. Baumgarten *et al.* (2004) identified that anyone from the overall population placed in a larger nursing home as well as people in 'for-profit' facilities were more likely to develop PIs however the reasons for this were unclear. Cai *et al.* (2010) drew on literature to show that people categorised as black were more likely to be in nursing homes with fewer financial resources; and went on to explore quality of care based on PIs within and across nursing homes. Drawing on data from the Nationwide Inpatient Sample (NIS) 2003, (Whalen *et al.* 2003) Fogerty *et al.* (2009) found that AA subgroups had 50.69% of people in the lowest income quartile in comparison to 21.4% Caucasians, which remains fairly stable over the lifespan. Similarly, Howard & Taylor (2009) identified that nursing homes with high populations of AAs tended to have more beds, with higher mean numbered care deficits as well as having higher mean poverty levels in comparison to white residents. It was also established within Cai *et al.*'s (2010) study that in New York State nursing homes people categorised as black had a higher rate (odds ratio 0.83) of experiencing risk adjusted negative outcomes than people categorised as white. The results state that people categorised as black were not disadvantaged within a care setting but were more likely to be in a nursing home that provides lower quality care; therefore, placing them at a higher risk of developing PIs. Moreover, nursing homes with greater than 85% Medicaid payer residents had a greater percentage of

Hispanics and nursing homes with 3% or more Hispanic residents were more likely to have an increased number of PIs (Gerardo *et al.* 2009).

DISCUSSION

Overall, with terms such as 'unable to stage' (VanGlider *et al.* 2008) and the difficulty of detecting early skin changes in DSTs (Sullivan 2014) it is likely that higher stage PIs develop, and could account for findings suggesting residents categorised as black or with DSTs having the highest rate of stage 2-4 PIs (Howard & Taylor 2009, VanGlider *et al.* 2008, Li *et al.* 2011). Although staging was not included in all the studies; various forms of guidance from the NPUAP was used to inform the process within all the studies reviewed. Strategies for staging PIs differed amongst the studies. One study (Anthony *et al.* 2002) made no reference to stages, only focusing on service users either having an existing PI or not therefore suggesting inclusion of all stages. Another study (Baumgarten *et al.* 2004) considered all ulcers reported on a skin sheet to be the result of PI if no other aetiology was stated whilst Gerardo *et al.* (2009) provided definition of the various stages.

Regardless of the NPUAP, EPUAP and Pan Pacific Pressure Injury Alliance referring to variances of presentation when assessing stage 1 PIs it is important to highlight that all individuals across the continuum of skin tone do not necessarily display the same characteristics (Sullivan *et al.* 2014). It can be suggested that all service users are being offered the same standard of care however people with DSTs face a health care disadvantage as early stage PIs may not be recognised and as a result a PI may worsen, meaning that people can experience longer hospital stays, become prone to infections, experience deterioration of their psychological and physical wellbeing, and even premature death (Agrawal & Chauhan, 2012). Despite there being modifications in PI staging to include various skin tones there are currently no valid or reliable tools available for assessment of early skin changes in people with DSTs (Harm *et al.* 2014). As people with DSTs are more likely to have a stage 2 PI than a stage 1 PI it is important to highlight Sullivan's (2014) research which indicated that non-blanchable erythema is a risk factor for more severe PIs amongst people with DSTs. Appropriate assessment strategies need to be managed during risk assessments and/or at the identification of a stage 1 PI to prevent higher stage damage (Gerardo *et al.*, 2009).

The literature revealed significant variation in the terminology used for the description of skin tones (Salcido 2016) and there was exclusion and lack of appropriate ethnic minority sample sizes to draw solid conclusions about identification of PIs. In some US-based studies (Gerardo *et al.* 2009, Harms *et al.* 2014, Ahn *et al.* 2016) figures were collated about people categorised as Hispanics nonetheless

these do not relate to the population structure of countries such as the United Kingdom, Australia, or Europe, meaning that generalisability outside of the US is restricted.

Most of the studies (Baumgarten *et al.* 2004, Fogerty *et al.* 2009, Gerado *et al.* 2009, Howard & Taylor 2009, Cai *et al.* 2010, Li *et al.* 2011, Harms *et al.* 2014, Ahn *et al.* 2016) were epidemiological, based on retrospective secondary data analysis where statistical analysis was not always used or appropriate. The studies analysed either explored prevalence or incidence of PIs and due to the variability of the aims as well as timing of each individual study, meta-analysis and comparison of the results were deemed to be inappropriate (Moore & Cowman 2011). Furthermore, with many of the studies having employed retrospective data analysis, attention is drawn to the possible limitations regarding reliability of the original data sets as well as coding inaccuracies and omissions which could confound results (Anthony *et al.* 2002). The use of naturalistic observation using the Braden scale, a skin assessment tool and documentary analysis (Bergstrom *et al.* 1996) remains unique within this literature review. Despite, Bergstrom *et al.* (1996) establishing that people categorised as white were more likely to develop a pressure ulcer it could be seen that the study faced methodological challenges. Within the clinical areas the staff would have been aware that observations were taking place therefore desirable behaviour would have been displayed and the nurses carrying out the observations would have had a conflict between the role of a researcher and practitioner (Newell & Burnand 2011).

With the exception of Bergstrom *et al.* (1996), all the papers from the United States (US) used data collected from larger surveys which measured quality of care. One of the most popular surveys used which specifically looks at Medicaid, a social care program, and Medicare, a social insurance program funded at the federal level, was the Minimum Data Set (MDS) (Vanglider *et al.* 2008, Fogerty *et al.* 2009, Gerado *et al.* 2009, Howard & Taylor 2009, Cai *et al.* 2010, Li *et al.* 2011, Harms *et al.* 2014, Ahn *et al.* 2016). Though Shin & Scherer (2009) & Chomiak *et al.* (2001) note that the MDS is a high quality survey and is contemporary, there are a number of potential limitations with the MDS because data is collected for regulatory rather than research purposes by clinicians. Ahn *et al.* (2016) noted that the MDS, a federally mandated tool was amended in 2012 to include suspected deep tissue injuries (SDTI), this was several years after the guidance from the NPUAP (Fleck 2007) which suggests that the MDS is not rapidly amendable in line with current evidence. Additionally, despite the MDS enabling the documentation of multiple or single PIs either the most severe PI recorded was used within data collection or this consideration was not acknowledged.

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PIs above stage 3 are considered 'never events' (Agency for Healthcare Research & Quality 2016), and increases the likelihood of death in hospitals (Lyder *et al.* 2012) which highlights the seriousness of the problem. Health disparities amongst people with different skin tones is not unique to PI identification and assessment as under-identification of skin trauma in people with DSTs has also been reported in sexual assault examination (Sommers *et al.* 2009).

Despite there being numerous campaigns to discuss international migration and population changes, the impact on health care provision has been limited which has resulted in a gap in service delivery. This review presents a critical synthesis of PI identification in people with DSTs and shows the area is under-researched, limited by poor methodological quality, with only a limited number of contemporary studies. Moreover, studies mainly focus on secondary data collected by health care professionals; no specific studies considered the opinions, thoughts or views of people with DSTs. Moving forward, research has to focus not only on pre-disposing factors such as clinical characteristics or cultural impact but on nurse ability to assess skin disparity in a variety of nursing environments which includes both in-patient and community settings.

CONCLUSION

Nurses are crucial sentinels for patient safety and quality care delivery. From the literature reviewed it can be seen that there is a lack of guidance and evidence, people with DSTs are more likely in comparison to people presenting with light skin tones to develop higher stage PIs, and this could well be associated with failure to accurately identify stage 1 pressure damage. Further research regarding nurse education and PIs should be carried out to help establish nurse baseline knowledge of PI identification and to develop more of an awareness of diversity issues in preventing and identifying pressure damage.

RELEVANCE TO CLINICAL PRACTICE

With international population demographic changes healthcare professionals in particular nurses need to be aware of diversity issues in relation to maintaining skin integrity and providing harm-free care. Correct assessment and early identification of PIs is essential to implement interventions and prevent further deterioration.

Review Limitations

The review was limited to the English language which may limit research into specific population groups with DSTs where the language may differ.

Contributions

Study design: XXX,XX,XX; Data collection and analysis: XXX,XX,XX; Manuscript preparation: XXX,XX,XX,XX

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Figure 1. Flowchart of literature search

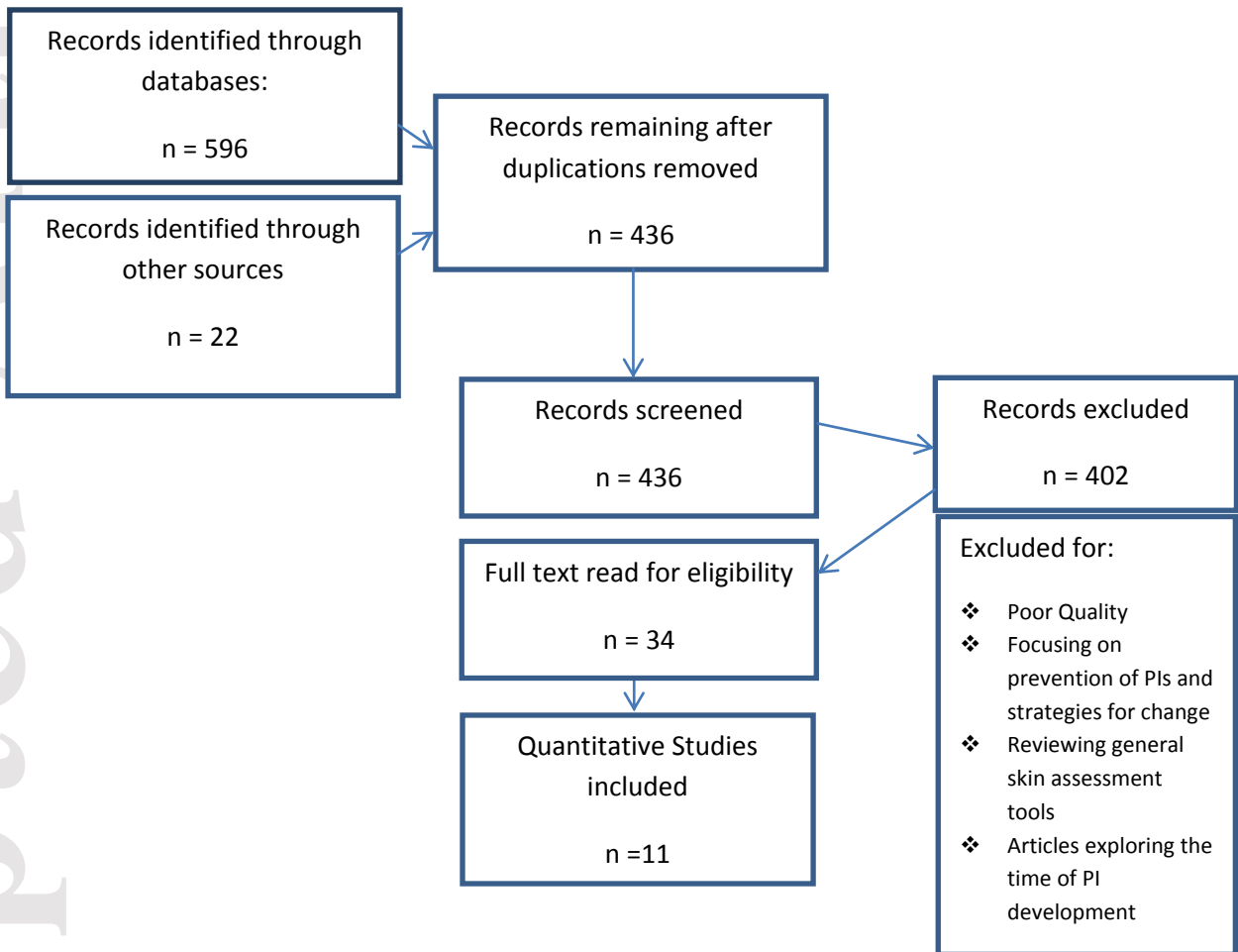


Table 1. Summary of included Studies

Author & Location	Aim	Sample Size	Design	Method of Data Collection	Summary of Findings
Ahn <i>et al.</i> (2016) United States, Nursing Homes.	To provide information on risk factors associated with PUs amongst nursing home residents.	2,936,146 residents	Retrospective Secondary Data Analysis	Minimum Data Set (MDS) January to December 2012	Risk factors were drawn from 4 elements of the Defloor's conceptual model and it was identified that residents categorised as black had a 1.76% increased likelihood of developing a PU in comparison to residents categorised as White.
Anthony <i>et al.</i> (2002) United Kingdom, Hospital.	To ascertain if there is a relationship between ethnicity and PUs.	45,735 admissions	Retrospective Secondary Data Analysis	Hospital Information Support System data from 1996 to 2000	Ethnicity was not seen as a significant risk factor. The odds ratio (OR) for people categorised as white to Pakistani was 10.3 for pressure ulcer on time of admission. It was established that there were inaccuracies within the data collected. Rather than explaining what the odds mean, I think this reviewer is suggesting that you are not stating what variable is calculated in the odds. This is odds for PI at time of admission.
Baumgarten <i>et al.</i> (2004) United States, Nursing Homes.	To compare the incidence of PU amongst residents categorised as black or white in nursing homes.	1,938 residents	Prospective cohort study conducted between 1992 and 1995	Either Interviews or MDS	Residents categorised as black were more likely to develop a PU in the nursing home in comparison to residents categorised as white (0.56 vs 0.35, respectively). However, the Hazard Ratio was reduced from 1.66 to 1.35 when multiple resident characteristics were controlled.
Bergstrom <i>et al.</i> (1996) United States, Multi-site study.	To determine the number of PUs amongst various population groups. To identify if demographic characteristics or primary diagnosis are risks of developing PU.	843 residents	Cohort Study	Observations of clinical practice.	As a significant difference in the total sample 15% of residents categorised as white had Stage 2 PUs in comparison to 5% of residents categorised as black (p=.02). Using logistic regression, race was seen as a significant predictor of PU development (OR = 2.73)
Cai, <i>et al.</i>	To determine whether	59,740	Retrospective	MDS and Online	The difference in the prevalence of PUs with stage 2

(2010) United States, Nursing Homes.	facility characteristics impact on PU development.	residents	Secondary Data Analysis	Survey Certification and Reporting January 2006 to January 2007	or greater between people categorised as white and blacks are due to across facility variations rather than within facility disparity. 18.2% of long term care residents categorised as black had PUs in comparison to 13.8% of people categorised as white. Results from the base logit model presents an OR=1.203 and $p<0.01$, with residents categorised as black more likely than people categorised as white to develop PUs.
Fogerty et al. (2009) United States, Nursing Homes	To identify what causes African Americans (AA) to be at higher risk of developing PU and if they have different rates of medical risk factors.	94,758 discharges	Retrospective Secondary Data Analysis	2003 Nationwide Inpatient Sample database	People categorised as AA (of all ages and either male or female) were 12% more likely to have a discharge diagnosis of a PU compared to people categorised as Caucasian. Females categorised as black over 75 were twice as likely to have a PU upon discharge in comparison to their Caucasian counterpart.
Gerardo et al. (2009) United States, Nursing Homes	To explore if there is a correlation between the prevalence of PU when there is an increased number of people from a categorised as Hispanic in a nursing home.	74,343 nursing home residents	Retrospective Secondary Data Analysis	Second quarter MDS 2000 and Online Survey Certification and Reporting data 2000	Residents categorised as hispanic (9.71%) and black (12.10%) had a higher incidence of PUs compared to residents categorised as white (7.60%).
Harms et al. (2014) United States, Nursing Homes	To explore at the prevalence of PUs by race and ethnicity amongst older adults admitted to nursing homes at the individual, nursing home and regional levels	111,640 nursing home resident admissions	Cross-sectional observational design Retrospective Secondary Data Analysis	MDS 2000 to 2002 and 2000 U.S Census tract data	Older adults admitted to nursing homes categorised as black (15%) or hispanic (11%) had a higher prevalence of the most severe PUs in comparison to older adults categorised as non-hispanic whites (6%).
Howard & Taylor (2009) United States,	To determine whether there is a variance between AA and White nursing	113,869 residents	Retrospective Secondary Data Analysis	MDS Atlanta Region from 1999 to 2002, the Online	People categorised as AA experienced a higher incidence rate of PUs at all stages expect stage 1 (risk ratio=0.61). People categorised as AA had 1.1%

Nursing Homes	home residents.			Survey Certification and Reporting database and the 2000 U.S. Census	incidence of having a stage 4 PU in comparison to 0.4% of people categorised as white, this was the greatest differential figure presented within the study.
Li <i>et al.</i> (2011) United States, Nursing Home	To explore the trend of PU prevalence among high-risk, long-term nursing home residents in relation to race and to identify if disparities are linked to place of care received.	2,136,764 white and 346,808 black residents.	Observational cohort study	MDS 2003 to 2008	Among high risk nursing home residents there was higher prevalence of PU amongst residents categorised as black (16.8% in 2003; 14.6% in 2008) compared to residents categorised as white (11.4% in 2003; 9.6% in 2008).
VanGlider <i>et al.</i> (2008) United States, Canada, Australia, Saudi Arabia and the United Arab Emirates.	To enable healthcare facilities to compare their PU prevalence against similar institutions.	447,930 records	Retrospective Secondary Data Analysis	Survey data from the International Pressure Ulcer Prevalence™ Survey were collected from 1989 to 2005.	The overall patient group was divided into dark, medium and light skin tones. Patients with dark skin tones had more severe staged-PU's in comparison to people with medium or light skin tones. Of the PU's recorded (N = 162296) 12.9% of people with dark skin tone had a stage 4 PU in comparison to 5.5% of people with a light skin tone.