What is the impact of topical preparations on the incidence of skin tears in older people? a systematic review

KEY WORDS
- Body wash
- Emollient
- Incidence
- Moisturiser
- Skin tears
- Topical preparations

DAYANG ANIS AWANK BAKI
School of Medicine, Royal College of Surgeons in Ireland University of Medicine and Health Sciences

PINAR AVSAR:
PhD, MSc, BSc, RGN Senior Postdoctoral Fellow. Skin Wounds and Trauma Research Centre. The Royal College of Surgeons in Ireland (RCSI), University of Medicine and Health Sciences, Dublin

DECLAN PATTON:
PhD, MSc, PGDipEd, PGCRM, BNS(Hons), RNT,RPN Director of Nursing and Midwifery Research and Deputy Director of the Skin, Wounds and Trauma Research Centre, School of Nursing and Midwifery, The Royal College of Surgeons in Ireland (RCSI), University of Medicine and Health Sciences, Dublin

Continued page 34

Objective: This systematic review aimed to determine the impact of topical preparations on the incidence of skin tears in older people. **Method**: A systematic search of publications using PubMed, CINAHL, SCOPUS, Cochrane and EMBASE databases was conducted in February 2021. A total of 11 records were returned, seven satisfying the inclusion criteria. Data were extracted using a predesigned data extraction tool and initially, a narrative synthesis was undertaken, followed by meta-analysis. Cochrane Collaboration tool was used to assess the risk of bias using RevMan. **Results**: The included studies (n=7) were conducted between 1997 and 2017. The mean sample size was 275 participants (SD= ±399.3). In total, six different interventions were employed, ranging from moisturising lotions, body wash, no-rinse skin cleanser and emollient soap. In the usual care groups, 41% (n=333/812) of participants developed a skin tear, whereas 27% (n=217/841) of participants in the different treatment groups developed a skin tear. The odds ratio of skin tear development was 2.09 (95% CI: 1.67 to 2.63; p=0.00001). This indicates that the control care group is twice as likely to develop a skin tear. All included studies were at risk of bias in one or more domains. **Conclusion**: The use of topical preparations reduces the incidence of skin tears in older people. However, due to the risk of bias seen in these studies more high-quality research is needed in the area to confirm this finding.

According to the International Skin Tear Advisory Panel (ISTAP) (LeBlanc et al, 2018), a skin tear is defined as a traumatic wound caused by mechanical forces, including removal of adhesives. Mechanical forces can be anything such as shear, friction, or trauma (LeBlanc et al, 2018). There are two types of skin tear described in the literature 'uncomplicated' or 'complicated'. While an acute wound that will heal within approximately four weeks refers to uncomplicated skin tear, a complicated skin tear can be seen particularly on the lower extremities and/or in patients with multiple comorbidities and it is more complex. In addition, more recently the skin flap has been considered a condition of a skin tear (Van Tiggelen et al, 2020). A flap in skin tears is defined as "a portion of the skin (epidermis/dermis) that is unintentionally separated (partially or fully) from its original place due to shear, friction, and/or blunt force" (Van Tiggelen et al, 2020).

Aging is associated with increased intrinsic and extrinsic bodily changes, where extrinsic exposures and effects are more prevalent causing the integrity and physiological function of the skin to decline (Farage et al, 2008). This causes the skin to weaken with a 20% reduction in dermal thickness, loss of elasticity, and decreased tensile strength (Leblanc and Baranoski, 2009). Skin also becomes more sensitive and exhibits a paper-thin appearance in older adults (Leblanc and Baranoski, 2009; Moncrieff et al, 2015). General causes of skin tears in older people are many, but not well documented, including; blunt trauma, falls while performing daily activities, dressing, during older

TOM O'CONNOR
EdD, MSc Ad Nursing, PG Dip Ed, BSc, Dip Nur, Director of Academic Affairs and Deputy Head of School, School of Nursing and Midwifery and Lead Researcher, Skin Wounds and Trauma Research Centre. The Royal College of Surgeons in Ireland (RCSI), University of Medicine and Health Sciences, Dublin.

AGLECIA BUDRI:
PhD, BSc, RGN Lecturer and Programme Director, School of Nursing and Midwifery. The Royal College of Surgeons in Ireland (RCSI), University of Medicine and Health Sciences, Dublin. s

LINDA NUGENT:
PhD, MSc Advancing Nursing Practice, FFNMRCSI, PG Dip Lecturer and Programme Director, School of Nursing and Midwifery. The Royal College of Surgeons in Ireland (RCSI), University of Medicine and Health Sciences, Dublin.

ZENA MOORE: *PhD, MSc (Leadership in Health Professionals Education), MSc (Wound Healing & Tissue Repair), FFNMRCSI, PG Dip, Dip First Line Management, RGN Professor of Nursing, Head of School of Nursing and Midwifery and Director of the Skin Wounds and Trauma Research Centre, The Royal College of Surgeons in Ireland (RCSI), University of Medicine and Health Sciences, Dublin*

people patient transfer, and injury from equipment (LeBlanc et al, 2013).

A small number of studies on skin tears have been published and many are based on retrospective reviews of medical reports (Malone et al, 1991; Strazzieri-Pulido et al, 2015; LeBlanc et al, 2008, LeBlanc et al, 2017). Notably, skin tears have been reported in the literature as having an equal or higher prevalence than pressure ulcers (PU) (Carville et al, 2007) An early study by Malone et al. (1991) suggested that more than 1.9 million adults developed skin tears each year in the US alone. Undoubtedly, this figure has risen due to the global increase in older people (Desa, 2015). A study conducted by Strazzieri-Pulido et al (2015), examining the prevalence of skin tears, concluded that nosocomial skin tear has a prevalence ranging from 3.3% to 22% and 5.5% to 19.5% in-home care (Strazzieri-Pulido et all, 2015). In Australia, the a reported skin tear prevalence was 4.5% to 19.5% in the community (LeBlanc et al, 2008).

Preventing skin tears is a key focus when caring for older people. Since dry skin is one of the modifiable risk factors for skin tears, the use of skin moisturiser is used to prevent dry skin (Kottner et al, 2013; Porter, 2018; Stephen-Haynes, 2012). To date, there has been no comprehensive review of studies to ascertain the impact of topical preparations such as creams, foams, gels, lotions, ointments, paste, moisturiser, and emollientson the incidence of skin tears (Surber et al, 2015).

Aim

The aim was to determine the impact of topical preparations on the incidence of skin tears in older people. The aim incorporated a structured approach to ensure all elements of the Population, Intervention, Comparison, Outcome (PICO) framework (Smith et al, 2011).

METHODS

Inclusion criteria

This systematic review includes published randomised control trials (RCTs) including cluster-RCTs, non-randomised controlled trials (NRCTs), prospective, retrospective and pre-post studies, and excluded all other articles that did not match these types of studies, and studies not written in the English language.

Adults aged 65 years old and above, in any healthcare setting. Any study stating the use of topical preparations such as creams, foams, gels, lotions, ointments, paste, moisturiser and emollients. Bed bath and soaps were also included.

Types of outcomes measured

The primary outcome was the incidence of skin tears at any grade and at any point during the study.

Secondary outcomes measured were:

- Stage of skin tear
- Adverse events
- Skin hydration.

Electronic searches

The following electronic databases were searched to identify the articles with the relevant inclusion and exclusion criteria:

- Cochrane Central Register of Controlled Trials (CENTRAL) (The Cochrane Library; latest issue)
- Ovid MEDLINE (1946 to search date)
- Ovid MEDLINE (In-Process & Other Non-Indexed Citations) (latest issue)
- Ovid EMBASE (1974 to search date)
- EBSCO CINAHL Plus (1937 to search date)
- Scopus.

To identify other published, unpublished and ongoing studies, the review team also searched in Google Scholar.

To identify further published, unpublished and ongoing studies, the review team

- Scanned the reference lists of all identified studies and reviews
- Searched grey literature using Open Grey (www.opengrey.eu)
- Searched international organisations reports (European Wound Management Association [EWMA], European Pressure Ulcer Advisory Panel [EPUAP[, and Wounds Australia).

The keywords used in the search included:

- #1 Older adults OR older adult OR elderly OR old person OR elder OR older persons OR elderly people OR aged OR old population OR older men OR aged OR old folks AND
- #2 (Topical preparations OR creams OR foams OR foam OR gels OR lotions OR lotion OR ointments OR paste OR moisturizer OR

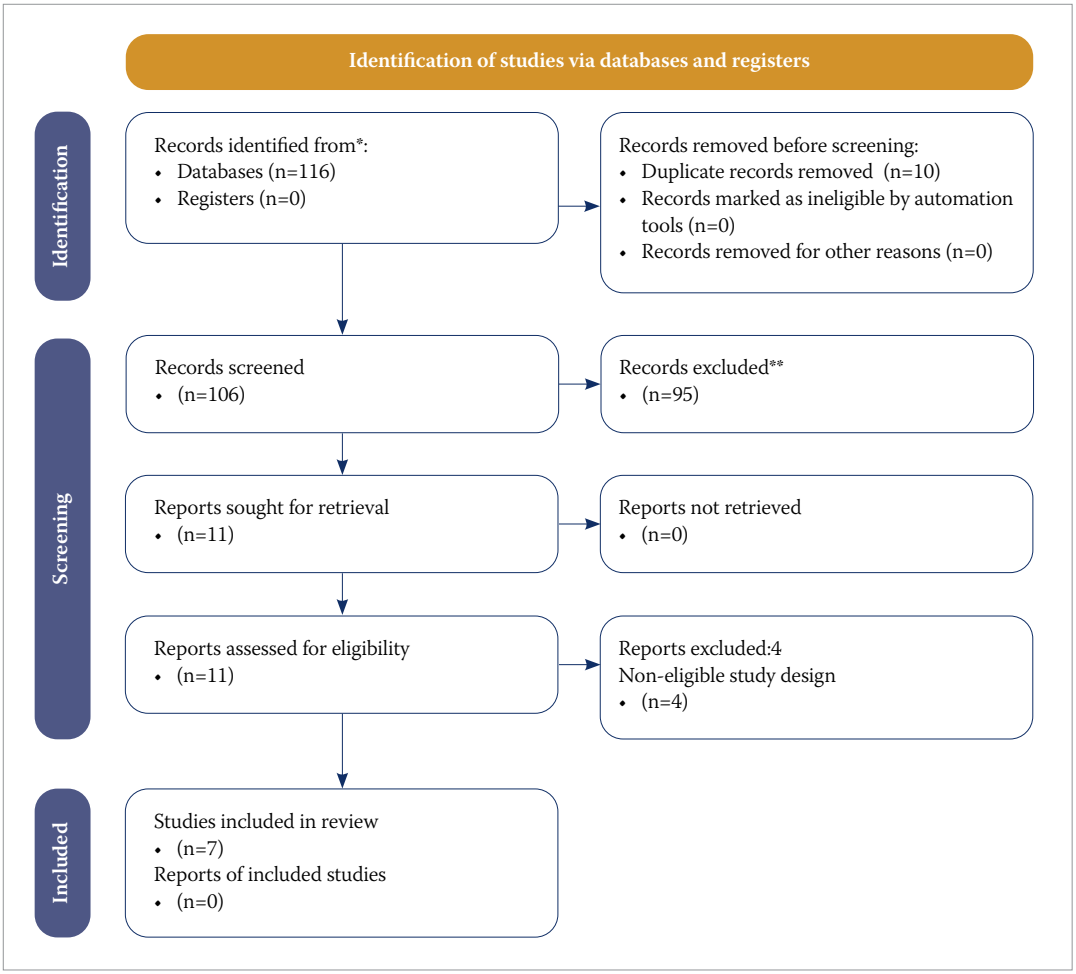


Figure 1. PRISMA 2020 flow diagram for study selection (Page et al., 2021)

moisturiser OR emollient OR emollients OR bed bath OR bed-bath OR soap OR soaps) AND

- #3 (Skin tears OR skin tear OR lacerations OR hydration)
- #4: #1 AND #2 AND #3

Study selection

The article titles were assessed by two authors (DB, PA) independently, and the abstracts of included studies were screened for their eligibility according to the inclusion and exclusion criteria. The full-text version of potentially relevant studies was obtained and two authors independently screened these against the inclusion criteria. Consensus between the two authors in relation to the studies was obtained through a discussion when discrepancies were identified by the third author.

Data extraction

Data from the retrieved articles were extracted and inserted into a table using the following headings: study name, author, date of study, country, setting, sample size, design, intervention, comparison, and outcomes.

Data analysis

In this review, following the extraction of the main findings from the papers, meta-analysis statistical synthesis was undertaken using RevMan Relative risks (RR) and 95% confidence intervals (CI) were calculated for dichotomous outcomes (The Nordic Cochrane Centre & The Cochrane Collaboration, 2014). In addition, a narrative synthesis of relevant data was undertaken for secondary outcomes. The quality of studies was assessed independently by two authors (ZM, PA), without blinding to the journal, or authorship, using the Cochrane Collaboration tool for assessing the risk of bias (Higgins and Green, 2011). This tool addresses six specific domains, namely sequence generation,

Table 1. Characteristics of excluded studies	
Study	**Reason for exclusion**
Shishido and Yano (2017)	Non-eligible study design; this is a pilot study
Cowdell et al. (2020)	Non-eligible study design; this is a literature review
LeBlanc et al. (2016)	Non-eligible study design; this is a literature review
Hodgkinson et al. (2007)	Non-eligible study design; this is a literature review

allocation concealment, blinding, incomplete outcome data, selective outcome reporting and other issues. It was assessed the blinding and completeness of outcome data for each outcome separately and completed a 'Risk of Bias' table for each eligible study.

RESULTS

Overview of included studies

After the completion of the search across all databases, data were merged and subsequently recorded within a PRISMA flow diagram (*Figure 1*; Page et al, 2021). Starting from the initial search, it was returned 116 records, of which seven met the inclusion criteria (Bank and Nix, 2006; Birch and Coggins, 2003; Carville et al, 2014; Gillis et al, 2016; Hahnel et al, 2017; Hunter et al, 2003; Mason, 1997). Out of these 11 articles, four were excluded for methodological reasons (*Table 1*).

Study design

The studies were conducted between 1997 to 2017. Of the included studies, there were three randomised controlled trials (Carville et al, 2014; Gillis et al, 2016; Hahnel et al, 2017), one quasi-experimental study with pre-post test study design (Hunter et al, 2003), one non-randomised quasi-experimental study with non-equivalent comparison (Bank and Nix, 2006), one retrospective study (Birch and Coggins, 2003) and one quasi-experimental study with time-series design (Mason, 1997).

Geographical locations

The geographical location of the studies varied between the US (Bank and Nix, 2006; Hunter et al, 2003; Mason, 1997), Germany (Hahnel et al, 2017), Belgium (Gillis et al, 2016), and Australia (Carville et al, 2014).

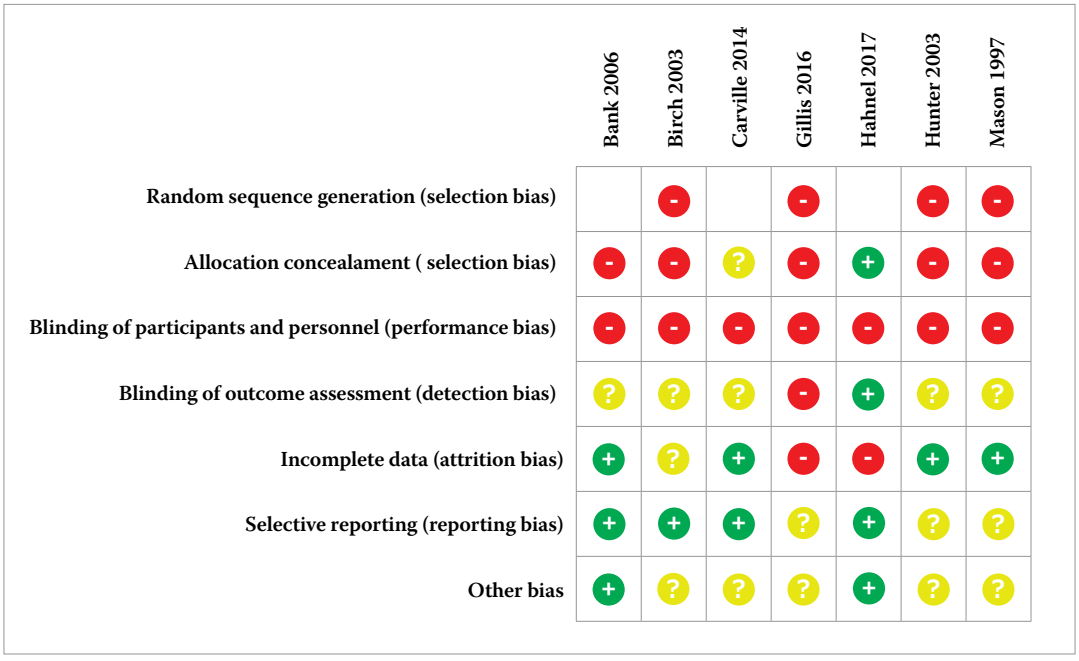


Figure 2. Risk of bias summary: review authors' judgement about each risk of bias item for each included study

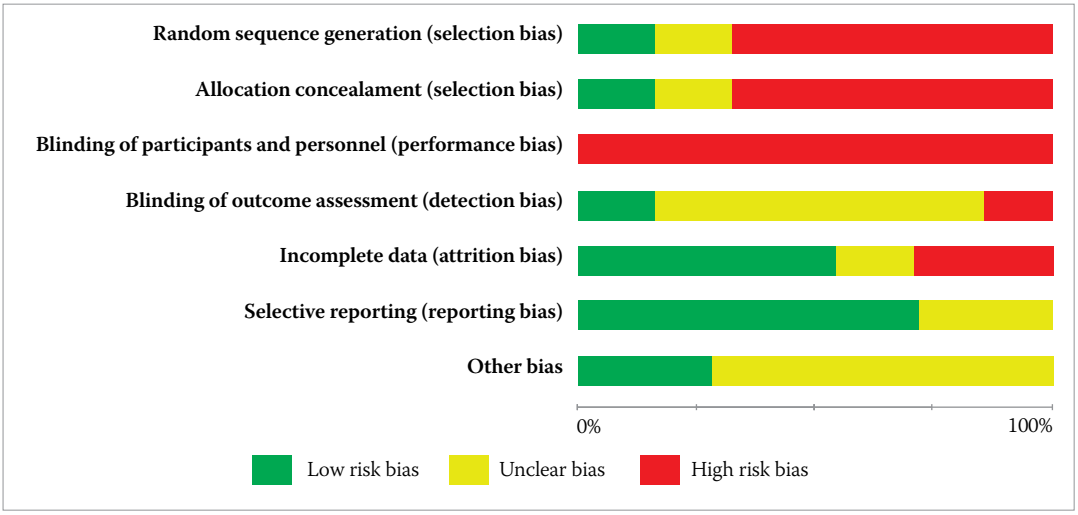


Figure 3. Risk of bias summary: review authors' judgement about each risk of bias item for each included study

Study settings

The study settings varied and included long-term care facilities (Birch and Coggins, 2003; Hahnel et al, 2017; Hunter et al, 2003; Mason, 1997), nursing homes (Gillis et al, 2016; Hunter et al, 2003), aged-care facilities (Carville et al, 2014) and nursing and rehabilitation centre (Bank and Nix, 2006).

Sample size

Across all studies, the mean sample size was 275 (SD: ±399.3), ranging from 43 (Mason, 1997) to 1164 participants (Carville et al, 2014).

Population

In all seven studies, the participants were all older people aged 65 years and above.

Risk of bias

The risk of bias in the included studies is summarised in *Figure 2* and *Figure 3*. Two review authors independently assessed the risk of bias for each study and resolved any disagreements through consensus.

Selection bias

Generation of the randomisation sequence

Hahnel et al (2017) have a low risk of bias since it used a computer-generated randomisation schedule with permutated blocks of random sizes. Carville et al (2014) did not provide information about the generation of randomisation sequence and therefore, this study was at unclear risk of bias. For the remaining five studies, the methodology of studies did not include this domain, therefore, was at high risk of bias (Bank and Nix, 2006; Birch and Coggins, 2003; Gillis et al, 2016; Hunter et al, 2003; Mason, 1997).

Allocation concealment

Only Hahnel et al (2017) indicated that allocation concealment was used in their study. Meanwhile, Carville et al (2014) did not provide information about the generation of randomisation sequence and therefore, were at unclear risk of bias. For the remaining five studies, the methodology of studies did not include this domain therefore, was at high risk of bias (Bank and Nix, 2006; Birch and Coggins, 2003; Gillis et al, 2016; Hunter et al, 2003; Mason, 1997).

Performance bias: blinding participants and personnel

All studies were at high risk of bias in this domain because it was impossible for participants and nurses to be blinded due to the nature of the studies (Bank and Nix, 2006; Birch and Nix, 2006; Carville et al, 2014; Gillis et al, 2016; Hahnel et al, 2017; Hunter et al, 2003; Mason, 1997).

Detection bias: blinding of outcome assessment

Only one study was at low risk of detection bias as they used independent reviewers to assess the study outcomes (Hahnel, 2017). As Gillis et al (2016) stated that a single-blinded or double-blinded design was not possible for this study, it was at high

risk. The rest of the studies did not mention or addressed the blinding of outcomes (Bank and Nix, 2006; Birch and Coggins, 2003; Carville et al, 2014; Hunter et al, 2003; Mason, 1997).

Attrition bias: incomplete outcome data

Four studies have a low risk of attrition bias since the number of participants was retained from the beginning of the study (Bank and Nix, 2006; Carville et al, 2014; Gillis et al, 2016; Hunter et al., 2003; Mason, 1997). Birch and Coggins (2003) had an unclear risk as insufficient information was provided permitting whether all participants were included in the final analysis. The other studies have a high risk of attrition bias due to withdrawals of participants and no recognition of having used intention to treat analysis (Gillis et al, 2016; Hahnel et al, 2017).

Reporting bias: selective reporting

Most of the studies have a low risk of selective reporting because all outcomes were reported (Birch and Coggins, 2003; Carville et al, 2014; Gillis et al, 2016; Hahnel et al, 2017; Mason, 1997) Gillis et al (2016) and Hunter et al (2003) had not involving clinical trials registry and insufficient information was provided for this domain. Therefore these studies were at an unclear risk of bias.

Other bias

Two studies were at low risk of bias in this domain, as other potential sources of bias were not identified (Bank and Nix, 2006; Hahnel et al, 2017). The remaining five studies were judged as unclear risk of bias in terms of funding source (Birch and Coggins, 2003; Carville et al, 2014; Gillis et al, 2016; Hunter et al, 2003; Mason, 1997)

Interventions and comparisons

The interventions included in this review are,

- Moisturising lotion versus usual care (Carville et al, 2014). The intervention included usual care in addition to the twice-daily application of a commercially available, standardised pH (5–6) neutral, perfume-free moisturising lotion to the patients' extremities using a gentle downward motion by staff or residents.
- Moisturiser and body wash versus usual care (Bank and Nix, 2006; Hunter et al, 2003). In Hunter et al (2003) the intervention was a combination of both the study products (Lantiseptic All Body Wash and Skin Protectant, Summit Industries, Marietta, Ga), in addition to the usual skin care routine. A skin cleanser, hair wash, and cleanser following soiling were used for the body wash. A moisture barrier was used for the treatment of incontinence associated skin injuries, category I and category II PUs, red, dry, and cracked skin. The skin protectant was applied at least every eight hours and after cleansing following an incontinence episode. There was no mention of the frequency of the body was application. In Bank and Nix (2006) the pH-balanced moisturizing body wash and body lotion were applied twice daily (Gentle Rain Extra Mild Sensitive Skin Moisturizing Body Wash and Shampoo and Xtra-Care All Body Lotion). In addition, they used skin sleeves and padded side rails for all older persons with a history of skin tears and they educated the staff on risk identification. The method of application of body wash and the body lotion was not mentioned in detail.
- No-rinse cleanser versus with soap and water only (Birch and Coggins, 2003). Birch and Coggins (2003) used a nondetergent, no-rinse cleanser (Nursing Care Personal Cleanser, Smith and Nephew, Inc., Largo, Fla.), for bathing bed-bound residents who were unable to bathe themselves or be taken to the shower. The nursing assistants sprayed the cleanser on a washcloth or directly on to the skin after an episode of incontinence, and then wiped the skin with a washcloth. The frequency of the intervention application was not mentioned.
- Body wash with disposable gloves versus usual care (Gillis et al, 2016). The procedure for the implementation of the intervention was that a package containing eight pre-moistened disposable washing gloves was warmed in a microwave for 30 seconds at 600W before use. The caregiver used at least four washing gloves to clean the resident's skin. The use of a towel to dry the skin was not allowed because it was advised to allow the lotion to evaporate. After a single-use, the wash gloves were thrown away. The wash gloves used in the study were

a non-woven Spunlaced 3D structure, with the ingredients mentioned in ***Table 2***. The intervention was carried out for 12 weeks.

- Body wash and lotion versus usual skin care (Hahnel et al, 2017). There were two intervention groups in the study by Hahnel et al (2017). Both groups used a moisturising body wash and a body lotion, for eight weeks. The differences were the ingredients in the products used ***(Table 2)***. No other products were used during the intervention period. The body wash was used once a day and the leave-on products were applied twice daily, once in the morning and one at night on both arms, both legs, and the trunk. Skin care was handled by the participants themselves but the nurses performed skin care procedures according to the protocol if self-application was deemed unlikely.
- Emollient soap versus with non-emollient soap (Mason, 1997). Participants were bathed three times a week using a plain emollient antibacterial soap for the first and third months, and non-emollient bacterial soap for the second and fourth months, all in a period of four months.

Outcomes

The primary outcome of this review was the

Table 2. Study characteristics

Authors and country	Design	Sample size	Intervention	Comparison
Carville et al. (2014) Australia	Cluster RCT	Intervention group = 543, control group = 621.	'Usual' care and twice-daily application of a commercially available, standardised pH (5–6) neutral, perfume-free moisturising lotion on the extremities using a gentle downward motion by staff or residents	Ad hoc or no standardised skin-moisturising regimen (usual care)
Hunter et al. (2003) USA	Quasi-experimental pretest/posttest design study	136	Skin protectant (SP) barrier ointment and bodywash (BW). SP is a non-prescription moisturiser, non-irritating, non-sensitising, nontoxic, noncytotoxic, with 50% lanolin, beeswax, petrolatum additives and fine grain emulsion. BW is a lanolin, non-irritating and pH balanced.	Usual care
Bank and Nix (2006) USA	Nonrandomised quasi-experimental study with a nonequivalent comparison	209	Implement skin care products such as Gentle Rain Extra Mild Sensitive Skin Moisturizing Body Wash and Shampoo and Xtra-Care All Body Lotion for twice-daily application. The use of skin sleeves and padded side rails was initiated for all patients with a history of skin tears and staff education programmes regarding risk identification and product use were implemented	Usual skin care (does not described further)
Birch and Coggins (2003) USA	Retrospective study	29	Nondetergent, no-rinse cleanser (Nursing Care Personal Cleanser, Smith and Nephew, Inc., Largo, Fla.) for bathing bed-bound residents who were unable to bathe themselves or be taken to the shower. Nursing assistants performed the one-step, no-rinse bath. Nursing assistant education regarding pressure ulcer prevention, including training on proper positioning and handling techniques, use of lift sheets, turning schedules, and incontinence cleansers, moisturisers, and moisture barrier ointments/pastes for skin care, is provided	Soap and water

Gillis et al. (2016) Belgium	Cluster RCT	122 randomised to intervention group, 14 withdrawals (5 no informed consent, 3 died, 2 stopped the intervention, 2 hospitalised), 46 randomised to control group, 4 withdrawals (1 moved to another nursing home, 1 hospitalised, 2 died)	Usual care (traditional bed bath) with use of "wash gloves" containing aqua, propylene glycol, coco-glucoside, phenoxyethanol, parfum, benzoic acid, polyaminopropyl biguanide, octyldodecanol, aloe barbadensis, glycine soja oil, dehydroacetic acid, sodium lauroamphoacetate, *Calendula officinalis* extract, Tilia cordata extract, *Melissa officinalis* extract, *Hamamelis virginiana* extract, *Echinacea purpurea* extract, *Chamomilla recutita* extract, *Centella asiatica* extract, *Aloe barbadensis* gel, tocopherol. The wash gloves are paraben free.	Usual care i.e.washing the residents with the well-known standard reusable cotton wash cloths, dipped in warm water combined with a bar of soap or liquid soap/oil
Hahnel et al. (2017) Germany	RCT with 3 parallel groups	117/133 residents (16 withdrawals)	Intervention group 1: (n=40) structured skin care regimen consisting of a moisturising body wash containing Shea butter and glycerine used daily and a moisturising leave-on hydrophilic water-in-oil emulsion lotion (body lotion) applied twice daily for 8 weeks. Intervention group 2: (n=41) structured skin care regimen consisting of glycerin-containing body wash used daily and a water-in-oil emulsion lotion (body lotion) containing emollients and 4% urea applied twice daily for 8 weeks	Control group 3: Usual skin care (does not described further)
Mason (1997) USA	Quasi-experimental, time series design	43	Emollient antibacterial soap	Non-emollient antibacterial soap

incidence of skin tears of any grade at any point during the study. The secondary outcomes of interest were the stage of skin tear, adverse events, and skin hydration. Staging of skin tear was not reported in the studies.

Five studies measured the primary outcome (Bank and Nix, 2006; Birch and Coggins, 2003, Carville et al, 2014; Hunter et al, 2003; Mason, 1997). Two secondary outcomes were measured, the adverse events or side effects of interventions, and skin hydration. Adverse events or side effects of interventions were reported by Hahnel et al (2017). Lastly, the effects of interventions on skin hydration were measured by Gillis et al (2016) and Hahnel et al. (2017).

Primary outcome: skin tear incidence

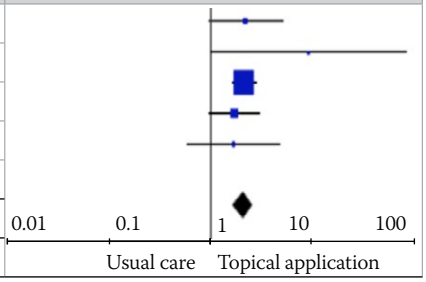
Skin tear incidence was reported in five studies (Bank and Nix, 2006; Birch and Coggins, 2003; Carville et al, 2014; Hunter et al, 2003; Mason, 1997). ***Table 3*** outlines the numbers of skin tears that were developed in each of the study groups. As can be seen, 41% (n=333/812) of the participants in the usual care groups developed

Table 3: Skin tear development in the included studies

Study	Usual care		Treatment group	
	Events	Total	Events	Total
Carville 2014	252	424	172	424
Mason 1997	12	43	6	43
Hunter 2003	43	136	29	136
Bank and Nix 2006	19	209	9	209
Birch and Coggins 2003	7	29	1	29
Total	**333**	**812**	**217**	**841**

Figure 4: Forest plot, odds ratio of skin tear development

Study or subgroup	Usual care		Topical application		Weight	Odds ratio M-H, Fixed, 95% Cl	Odds ratio M-H, Fixed, 95% Cl
	Events	Total	Events	Total			
Bank 2006	19	209	9	209	7.8%	22.2 (0.98, 5.03)	
Birch 2003	7	29	1	29	0.7%	8.91 (1.02, 77.91)	
Carville 2014	252	424	172	424	66.9%	2.15 (1.63, 2.82)	
Hunter 2003	43	136	29	136	19.0%	1.71 (0.99, 2.95)	
Mason 1997	12	43	8	43	5.5%	1.69 (0.61, 4.68)	
Total		**841**		**841**	**100%**	**2.09 (1.67, 2.63)**	
Total events	333		219				



Heterogeneity: Chi²= 2.31, df= 3 (P=0.51); I²= 0%
Test for overall effect; Z= 6.32 (P<0.00001)

a skin tear, whereas 26% (n=217/841) of the participants in the treatment groups developed a skin tear.

A meta-analysis was undertaken to determine the Odds Ratio (OR)of skin tear development in the usual care versus treatment groups. *Figure 4* outlines the result of this analysis and as can be seen, the OR is 2.09 (95%CI: 1.67 to 2.63; p=0.00001). This indicates that the usual care group is twice as likely to develop a skin tear.

Outcome 2: skin hydration

Two studies reported the skin hydration effects of the intervention (Gillis et al, 2016; Hahnel et al, 2017).

Gillis et al (2016) measured skin hydration objectively at the level of the stratum corneum by using the Moisture-Meter SC (Delfin Technologies Ltd), and the system was calibrated daily by the researchers for precise measurement. An arbitrary unit (AU) was used to measure skin hydration. The skin hydration at the level of the stratum corneum was measured before and after 12 weeks of intervention enforcement at the left cheek, right hand, and legs. During the intervention application, two skin hydration measurements were made at a minimum 3-hour and maximum 7-hour intervals and used for average skin hydration analysis. During the study, the temperature and humidity of the room where the participants stayed were observed in order to reduce the differences between the environments from the skin hydration measurement.

The result of the pre-hydration score at all skin sites with fixed effects treatment group, skin site, and interaction between skin site and treatment was obtained by creating a generalised linear mixed model for. It showed no significant differences between the control (n=42) and intervention groups (n=108) in terms of hydration (p=0.412). Nevertheless, there is a difference in AU differences where the score is higher in the intervention group than in the control group. The difference between post-intervention minus pre-intervention between the intervention and control group was 5.22AU for the leg, 1.84AU for the hand, and 16.33AU for the cheek. Since data are presented on a limited graph presentation without stating whether there are means, medians, or other measures, the data could not be further analysed. However, there is a significant difference between skin sites (p<0.001), with the skin at the cheek (22.7AU) compared with the hand (17.8AU; p<0.001). The mean hydration score of the legs was 18.6AU and significantly lower than the cheek (p=0.003). As for gender, skin hydration for female residents was higher than for male residents (3.7AU difference; p=0.044).

In the second study by Hahnel et al (2017), the skin hydration measurement was taken at the stratum corneum level, but by using a different biophysical skin measurement device; Corneometer CM 825 (Courage + Khazaka, Cologne, Germany). The unit used to measure skin hydration was an arbitrary unit (AU), with a range from 0 to 120. The higher readings indicate greater stratum corneum hydration. Similar to Gillis et al (2016), the skin hydration measurement was taken before and after the intervention of 8 weeks of study across all three groups; one control

group and two intervention groups. The first measurement was considered as the baseline. Any skin care was prohibited for 12 hours before skin hydration measurement to enhance the validity of the data. The measured skin sites include midvolar forearm and lower leg. Hahnel et al (2017) reported that mean stratum corneum hydration was higher in all three groups at both midvolar forearm and lower leg at the end of the study, and there were no statistically significant differences between the three groups when compared at midvolar forearm (p=0.691) and lower leg (p=0.056).

Outcome 3: side effects of the intervention

Hahnel et al (2017) reported side effects in their intervention groups. The side effect was seen in the intervention group I included a case of severe irritation and redness of the whole body, mild itching and redness in both arms, and a moderate rash after facial application. For intervention in group II, the side effect recorded was mild skin dryness at the back, presented in one participant.

DISCUSSION

The main goal of this systematic review was to investigate the impact of topical preparations on the incidence of skin tears in older persons. After a rigorous search, a total of seven studies with a total sample size of 1925 were included. Five studies assessed the primary outcome incidence of skin tears (Bank and Nix, 2006; Birch and Coggins, 2003; Carville et al, 2014; Hunter et al, 2003; Mason, 1997). The topical preparations included moisturising lotions, body wash, no-rinse skin cleanser, and emollient soap. A meta-analysis was conducted on the results from these studies and findings showed that the use of topical preparations reduces the incidence of skin tears in older persons. However, all included studies were at risk of bias in one or more domains. Further, the studies were all conducted in residential care facilities rather than acute hospitals. Therefore, the results of the meta-analysis should be interpreted with caution.

Secondary outcomes measured were skin hydration and side effects of the intervention. Two studies reported on skin hydration (Gillis et al, 2016; Hahnel et al, 2017), Results reported that there was no statistical significance in skin hydration between the study groups. Importantly, both studies included hand and legs as skin sites, which is plausible since skin tears are more prone to occur on both extremities (Gillis et al, 2016). Gillis et al, (2016) identified a significant difference if skin hydration was compared based on skin sites. The fact that the skin on the arms and legs is less moist than the skin on the cheek can be explained by its more prone skin tears. One study (Hahnel et al, 2017) reported the side effects of the intervention and four participants experienced irritation, redness, and itching. However, the sample size in this study is small (40 participants for the intervention group), the number of events relatively few, meaning there is imprecision in the findings. Thus, further research is needed to validate these findings.

The risk of bias was assessed according to six domains for all studies: sequence generation, allocation concealment, blinding, incomplete outcome data, selective outcome reporting, and other issues. All included studies were at risk of bias in one or more domains. Interpretations and thus, a conclusion of the effects of the interventions should be drawn against the background of these findings. Blinding was poorly reported, with incomplete blinding of investigators, participants, outcome assessors, and the data analyst, in most studies. Blinding of participants and caregivers is difficult to achieve in wound care; blinding of outcome assessors is possible, and was achieved only by Hahnel et al (2017). Due to the high risk of bias in the domains the results should be interpreted with caution.

The rationale for using intention-to-treat analysis is two-fold; it maintains treatment groups that are similar (apart from random variation) and therefore validates the use of randomisation, and allows for handling of protocol deviations, further protecting the randomisation process (Hollis and Campbell, 1999). Two studies were at high risk of bias in this domain, as they did not conduct intention to treat analysis for attrition bias. (Gillis et al, 2016; Hahnel et al, 2017). In essence, omitting those who do not complete the study from the final analysis may bias the outcomes of the study because those who do not complete may do so because of the adverse effects of the intervention.

(Montori and Guyatt, 2001). Thus, due to the high risk of bias in the domains the results should be interpreted with caution. Further research would provide greater clarification of this finding. Despite these limitations, the review has identified using topical preparations may be of benefit in decreasing the number of skin tears that develop in the elderly in practice. In addition, in terms of research, more high-quality research is needed to explore the relationship between the impact of topical preparations and skin tears.

Conclusion

This systematic review has identified a relationship between using topical preparations and the reduction in the development of skin tears. However, further research is needed since most of the included studies' methodological quality was considered invalid. Skin tears are painful, adversely affect the quality of life, and can lead to infections if neglected. However, using topical preparations may be of benefit in decreasing the number of skin tears that develop in the elderly, although all the included studies were at risk of bias in one or more domains. Thus, due to the high risk of bias in the domains the results should be interpreted with caution. Apart from that, it is also suggested that in the future, studies are made to find out the cost after skin tear intervention to the facilities and healthcare settings.

REFERENCES

Bank D, Nix D (2006) Preventing skin tears in a nursing and rehabilitation center: an interdisciplinary effort. *Ostomy Wound Manage* 52(9): 38–46.

Birch S, Coggins T (2003) No-rinse, one-step bed bath: the effects on the occurrence of skin tears in a long-term care setting. *Ostomy Wound Manage* 49(1): 64–67.

Carville K, Leslie G, Osseiran-Moisson R, Newall N, Lewin G (2014) The effectiveness of a twice-daily skin-moisturising regimen for reducing the incidence of skin tears. *Int Wound J* 11(4):446–453. https://doi.org/10.1111/iwj.12326

Carville K, Lewin G, Newall N, Haslehurst P, Michael R, Santamaria N, Roberts P (2007). STAR: a consensus for skin tear classification. *Primary Intention* 15(1):18

Desa, U. (2015). United nations department of economic and social affairs, population division. world population prospects: The 2015 revision, key findings and advance tables. In Technical Report: Working Paper No. ESA/P/WP. 241.

Farage M, Miller K, Elsner P, Maibach H (2008). Intrinsic and extrinsic factors in skin ageing: a review. Int J Cosmet Sci 30(2):87–95. https://doi.org/10.1111/j.1468-2494.2007.00415.x

Gillis K, Tency I, Roelant E et al (2016) Skin hydration in nursing home residents using disposable bed baths. *Geriatr Nurs* 37(3):175–9. https://doi.org/10.1016/j.gerinurse.2015.11.003

Hahnel E, Blume-Peytavi U, Trojahn C et al (2017). The effectiveness of standardized skin care regimens on skin dryness in nursing home residents: a randomized controlled parallel-group pragmatic trial. Int J Nurs Stud 70:1–10. https://doi.org/10.1016/j.ijnurstu.2017.02.006

Higgins J, Green S (eds). Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0 [updated March 2011]: The Cochrane Collaboration, 2011

Hollis S, Campbell F (1999) What is meant by intention to treat analysis? Survey of published randomised controlled trials. *BMJ* 319(7211):670–4. https://doi.org/10.1136/bmj.319.7211.670

Hunter S, Anderson J, Hanson D et al (2003) Clinical trial of a prevention and treatment protocol for skin breakdown in two nursing homes. J *Wound Ostomy Continence Nurs* 30(5):250–8.

Kottner J, Lichterfeld A, Blume- Peytavi U (2013) Maintaining skin integrity in the aged: a systematic review. *Br J Dermatol* 169(3): 528–42. https://doi.org/10.1111/bjd.12469

LeBlanc K (2017) Skin tear prevalence, incidence and associated risk factors in the long-term care population. https://tinyurl.com/4mpka9a4 (accessed 31 May 2021)

Leblanc K, Baranoski S (2009) Prevention and management of skin tears. Adv Skin Wound Care 22(7):325–32. https://doi.org/10.1097/01.asw.0000305484.60616.e8

LeBlanc K, Christensen D, Cook J et al (2013) Prevalence of skin tears in a long-term care facility. *J Wound Ostomy Continence Nurs* 40(6):580–4. https://doi.org/10.1097/won.0b013e3182a9c111

LeBlanc K, Christensen D, Orsted H et al (2008). Prevention and treatment of skin tears. Wound Care Canada 6(1):14-30. https://tinyurl.com/dnb5r4e8 (accessed 31 May 2021)

Leblanc K, Campbell K, Wood E, Beeckman D (2018) Best practice recommendations for the prevention and management of skin tears in aged skin: an over-view. *J Wound Ostomy Continence Nurs* 45(6):540–542. https://doi.org/10.1097/won.0000000000000481

Malone M, Rozario N, Gavinski M, Goodwin J (1991)The epidemiology of skin tears in the institutionalised elderly. J Am Geriatr Soc 39(6):591–595. https://doi.org/10.1111/j.1532-5415.1991.tb03599.x

Mason S (1997) Type of soap and the incidence of skin tears among residents of a long-term care facility. *Ostomy Wound Manage* 43(8):26–30

Moncrieff, G., Van Onselen, J., & Young, T. (2015). The role of emollients in maintaining skin integrity. Wounds UK, 11(1).

Montori, V. M., & Guyatt, G. H. (2001). Intention-to-treat principle. Cmaj, 165(10), 1339-1341.

Page MJ, McKenzie JE, Bossuyt PM et al (2021) The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 372:n71. https://doi.org/10.1136/bmj.n71

Porter M (2018) No tears for skin tears. Br J Community Nurs 23(10):478–80. https://doi.org/10.12968/bjcn.2018.23.10.478

Smith V, Devane D, Begley CM, Clarke M (2011) Methodology in conducting a systematic review of systematic reviews of healthcare interventions. *BMC Med Res Methodol* 11(1):15. https://doi.org/10.1186/1471-2288-11-15

Stephen-Haynes J (2012) Skin tears: achieving positive clinical and financial outcomes. *Br J Community Nurs* 17(Sup3):S6–16. https://doi.org/10.12968/bjcn.2012.17.sup3.s6

Strazzieri-Pulido KC, Peres GRP, Campanili TCGF, de Gouveia Santos VLC (2015) [Skin tear prevalence and associated factors: a systematic review]. [Article in Portuguese] *Rev Esc Enferm USP* 49(4):674–80. https://doi.org/10.1590/s0080-623420150000400019

Surber C, Brandt S, Cozzio A, Kottner J (2015) Principles of skin care in the elderly. *G Ital Dermatol Venereol* 150(6): 699–716.

The Nordic Cochrane Centre, & The Cochrane Collaboration. (2014). Review Manager (RevMan) (Version Version 5.3.5). Copenhagen.

Van Tiggelen H, LeBlanc K, Campbell, K et al (2020). Standardizing the classification of skin tears: validity and reliability testing of the International Skin Tear Advisory Panel Classification System in 44 countries. *Br J Dermatol* 183(1):146–54. https://doi.org/10.1111/bjd.18604