

BMJ Open is committed to open peer review. As part of this commitment we make the peer review history of every article we publish publicly available.

When an article is published we post the peer reviewers' comments and the authors' responses online. We also post the versions of the paper that were used during peer review. These are the versions that the peer review comments apply to.

The versions of the paper that follow are the versions that were submitted during the peer review process. They are not the versions of record or the final published versions. They should not be cited or distributed as the published version of this manuscript.

BMJ Open is an open access journal and the full, final, typeset and author-corrected version of record of the manuscript is available on our site with no access controls, subscription charges or pay-per-view fees (<u>http://bmjopen.bmj.com</u>).

If you have any questions on BMJ Open's open peer review process please email <u>info.bmjopen@bmj.com</u>

BMJ Open

BMJ Open

Patients' experiences with the application of medical adhesives to the skin: a qualitative systematic review

Journal:	BMJ Open
Manuscript ID	bmjopen-2024-089773
Article Type:	Original research
Date Submitted by the Author:	07-Jun-2024
Complete List of Authors:	Hofman, Hannelore; Ghent University Faculty of Medicine and Health Sciences, Public Health and Primary Care Duljic, Tanja; Örebro University, School of Health Sciences, nursing science unit ; Swedish Centre for Skin and Wound Research Johansson, Sara; Creative Mammals Beeckman, Dimitri; Ghent University, Department of Public Health and Primary Care; Swedish Centre for Skin and Wound Research Kottner, Jan; Charité Universitätsmedizin Berlin Kinnaer, Lise-Marie; Ghent University, Department of Public Health and Primary Care Eriksson, Mats; Örebro University
Keywords:	Systematic Review, PAIN MANAGEMENT, Patients





I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our <u>licence</u>.

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which <u>Creative Commons</u> licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

terez oni

Enseignement Superieur (ABES) Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies



Enseignement Superieur (ABES) Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

Patients' experiences with the application of medical adhesives to the skin

Title page

TITLE

Patients' experiences with the application of medical adhesives to the skin: a qualitative systematic review

AUTHORS

Hannelore **Hofman**^{1,\$}, Tanja **Duljic**^{2, 3, \$}, Sara **Johansson**⁴, Jan **Kottner**⁵, Lise-Marie **Kinnaer**¹, Dimitri **Beeckman**^{1,2}, Mats **Eriksson**^{3, *}

AFFILIATIONS

¹ University Centre for Nursing and Midwifery, Department of Public Health and Primary Care, Faculty of Medicine and Health Sciences, Ghent University, Ghent, Belgium ² Swedish Centre for Skin and Wound Research (SCENTR), Faculty of Medicine and Health, School of Health Sciences, Örebro University, Örebro, Sweden ³ Faculty of Medicine and Health, School of Health Sciences, Örebro University, Örebro

³ Faculty of Medicine and Health, School of Health Sciences, Örebro University, Örebro, Sweden

⁴ Creative Mammals, Gothenburg, Sweden

⁵ Institute of Clinical Nursing Science, Charité Center for Health and Human Sciences, Charité-Universitätsmedizin, Berlin, Germany

CORRESPONDING AUTHOR

*Mats Eriksson, Örebro University, Faculty of Medicine and Health, School of Health Sciences, Fakultetsgatan 1, SE-701 82 Örebro, Sweden Twitter: @mats_matseswe Email: mats.h.eriksson@oru.se

OTHER AUTHOR FOOTNOTES

^{\$}Hannelore Hofman and Tanja Duljic made equal contributions to this manuscript (joint first authorship)

KEYWORDS

Adhesives; Discomfort; Meta-Aggregation; Pain; Patient Experiences; Skin; Systematic Review

WORD COUNT

3.540 words

Page | 1

Patients' experiences with the application of medical adhesives to the skin

Abstract

INTRODUCTION

Medical adhesives are used in a variety of products such as tapes, dressings, electrodes, ostomy supplies and patches. They provide securement of medical devices, facilitate skin protection and allow noninvasive monitoring. Application and removal of medical adhesives can result in pain, dermatitis, trauma or other skin lesions. Understanding patients' experiences when subjected to medical adhesives will contribute to the improvement of clinical routines and the development and improvement of new adhesive technologies.

OBJECTIVES

This qualitative systematic review aimed to identify patients' experiences with the application of medical adhesives to the skin.

METHODS

Four electronic databases were systematically searched for records published between January 2012 and March 2024: CINAHL, EMBASE, MEDLINE and PsycINFO. Reference lists of systematic reviews and of included articles were reviewed. Studies reporting qualitative data on the experiences of patients with the application of medical adhesives to the skin were considered. Study selection and data extraction was independently conducted by two reviewers. Data were synthesized using meta-aggregation. (PROSPERO registration: CRD42023457711)

RESULTS

Nine studies describing patients' experiences with the application of medical adhesives to the skin were included. The included studies only reflected experiences with wound dressings. Meta-aggregation of the extracted findings resulted in seven categories that were further synthesized into two synthesized findings: 'Strategies to alleviate pain during dressing changes' and 'Dressing construction and characteristics'. The synthesized findings illustrate that patients experience pain during dressing change and removal and employ strategies to alleviate this pain.

CONCLUSIONS

Patients experience pain and discomfort when dressings are changed or removed. Future research should focus on enhancing both routines and technologies, with a particular emphasis on advancing skin-friendly adhesives to reduce unwanted side effects.

KEYWORDS

Adhesives; Discomfort; Meta-Aggregation; Pain; Patient Experiences; Skin; Systematic Review

Patients' experiences with the application of medical adhesives to the skin

Article summary

STRENGTHS AND LIMITATIONS OF THIS STUDY

- This systematic review summarizes qualitative evidence on the experiences of patients with the application, presence and removal of medical adhesives from the skin using meta-aggregation.
- This review identified knowledge gaps in qualitative research regarding patients' experiences with the use of medical adhesives.
- This study focused on synthesizing qualitative evidence regarding patients' • experiences with the application of medical adhesives to the skin and did not include ΦVIDE.. quantitative evidence.

Main text

INTRODUCTION

Medical adhesives are defined as adhesives used in medical devices to establish and maintain contact with the body over a period of time (usually by application to the skin). They are a component of a variety of products, including bandages and dressings for wound care, ostomy supplies and patches, adhesive film or tape to secure various catheters, tubes and electronic devices (e.g. adhesives used for securing ECG and EEG electrodes to the skin) (1, 2). Medical adhesives are frequently used in an array of healthcare settings in all patient groups. From premature babies, who often require medical adhesives to secure nasogastric and ventilation tubes, to patients with an ostomy who frequently have to reapply the adhesive stoma products to their skin. In an acute care facility in the United States, a median of 3.00 - 6.25 adhesive products were used on the skin per patient per day (3).

Patients may experience pain when changing the medical adhesive (4, 5). The patient's perception of pain is influenced by several factors such as mental and physical health conditions, previous negative experiences, types of medical adhesive used (6). Therefore it has been recommended to perform a pain assessment at every dressing change (7). Pain and discomfort can cause chronic stress, which might result in impaired wound healing (8, 9). Especially in children, pain can lead to emotional trauma and even posttraumatic stress (10, 11), which potentially results in avoidance of trauma reminders and negative moods or cognitions (12). Pain is defined as "An unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage" (13). Activation of nociceptors in the epidermis sends signals about potential or actual tissue damage which causes the experience of pain (14). This starts an autonomic stress response which includes heart rate elevation and metabolic changes. Stress exacerbates the pain experience (14).

Skin damage can cause pain and discomfort in patients (9, 15-17). Application and removal of medical adhesives to the skin can lead to skin stripping, contact dermatitis, or allergic reactions that may manifest as inflammation associated with itching or pain. Adhesive-related skin injury can lead to infection, delayed wound healing and an increased risk of scarring (2). Medical adhesive-related skin injury (MARSI) occurs when the adhesive material's adhesion to the skin is stronger than the adhesion between the skin's cells upon removal. This leads to the separation of epidermal layers or the complete detachment of the epidermis from the dermis, observed as erythema, cuts and blisters (7). Medical adhesive related skin injuries can occur in any patient, but elderly patients and newborns are particularly susceptible (18-20).

Despite the frequent use, medical adhesive related injuries are rarely reported (7). Previous studies have shown that nurses did not take action to prevent pain and skin tearing when carrying out dressing change (17). Understanding the patient's experience with medical adhesives is crucial for raising awareness among healthcare professionals to minimize adverse effects and enhance patient outcomes during the use of medical adhesives.

Therefore this systematic review aimed to answer the following research question: "What are patients' experiences with the application of medical adhesives to the skin?"

Patients' experiences with the application of medical adhesives to the skin

Enseignement Superieur (ABES) Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies.

METHODS

This systematic review is reported according to the Enhancing Transparency in Reporting the Synthesis of Qualitative Research statement (ENTREQ) criteria (21). Meta-aggregation was used to synthesize the results based on the guideline from the Joanna Briggs Institute (JBI) (22). This review is registered with the PROSPERO International Prospective Register of Systematic Reviews (registration number: CRD42023457711). The protocol of this review has been published previously (23).

Search strategy and information sources

A two-step strategy was used to identify relevant studies. First, a systematic search in four electronic databases was conducted: CINAHL (accessed through the EBSCO interface), EMBASE (accessed through Elsevier), MEDLINE (accessed through the Ovid interface) and PsycINFO (accessed through the EBSCO interface). For the initial searches in MEDLINE the concepts 'experience' (keywords include 'pain', 'dermatitis', 'itching', 'pruritus' and 'discomfort') and 'removal of dressings' (keywords include 'adhesive', 'bandage', 'dressing', 'adverse event', 'device deficiency', 'removal', 'change' and 'application') were used. The initial search strategy was customized for each electronic database (see supplementary file 1). Second, the reference lists of relevant systematic reviews and included articles in this review were screened to identify additional studies that were not retrieved through the first strategy.

Eligibility criteria

Population and context

This review focused on patients who currently or in the past had medical adhesives applied to their skin. There were no restrictions regarding sex or age.

Phenomena of interest and study design

Studies were included in the review if they collected qualitative data on the experience of patients with the application of medical adhesives to the skin. Both qualitative studies and qualitative data from mixed method studies were considered.

Setting, language and time frame

There were no restrictions regarding settings. Articles published in English, Swedish, Dutch, German, Danish and Norwegian were considered. Due to continuous technological advances in the field of medical adhesives (24-26), this review tried to focus on medical adhesives that are currently still being used in clinical practice by restricting the search period. Therefore, the initial search was conducted to identify records with a publication date between January 2012 and November 2022. The search was repeated in March 2024 to identify any additional studies.

Study selection, data collection and management

All databases underwent individual searches, and the retrieved records were then exported into Covidence software for systematic reviews (Veritas Health Innovation, Melbourne, Australia). Following this, duplicates were identified and subsequently eliminated. The screening of records was conducted independently by two reviewers (HH, TD). In case of disagreement, discussions were held until consensus was reached. If there was no consensus, a third member of the review team was consulted (ME or DB). First, the titles and abstracts of the records were screened against the inclusion criteria. In a second round, the full text of the selected articles was screened.

Patients' experiences with the application of medical adhesives to the skin

Assessment of methodological quality

The methodological quality of the studies under consideration was assessed independently by two reviewers (HH, TD). The Joanna Briggs Institute Critical Appraisal Tool for Qualitative Research was used (27). In cases of disagreement, discussions were held among the reviewers to reach consensus about the methodological quality. If necessary, a third reviewer was involved to resolve remaining disagreements (DB).

Data extraction

From the included studies, (a) bibliographic information (lead author, year, title, journal, full citation) (b) study design and sample size, (c) patient demographics, setting and geographical context, (d) description of how the research findings are addressed in the article, (e) method of data collection, (f) method of data analysis, (g) context (product names/brands or type of material of medical adhesives investigated), (h) phenomenon of interest (experience of patients with the application of medical adhesives to the skin) and (i) findings and illustrations were extracted. In meta-aggregation, a finding is defined as 'a verbatim extract of the author's analytical interpretation of the results or data'. An illustration is 'a direct quotation of a participant's voice, fieldwork observation or other supporting data from the paper' (22).

Data extraction was independently conducted by two reviewers (HH, TD), with any ambiguities addressed through discussion within the research team. Final data extraction was accomplished through reviewer discussions, ensuring consensus was reached. Another member of the research team (ME, DB) performed quality control of the extracted data on 20% of the included articles.

Data synthesis

Meta-aggregation was used to summarize the evidence. A level of plausibility was allocated to each extracted finding: unequivocal (i.e., findings accompanied by an illustration that is beyond reasonable doubt), equivocal (i.e., findings accompanied by an illustration lacking clear association with the finding and therefore open to challenge) and unsupported (i.e., findings that are not supported by the data). Unsupported findings do not appear in the data synthesis (22, 27).

Meta-aggregation was completed according to the following steps: (a) each article was read repeatedly to extract all findings from the results and discussion section of the included studies, accompanied by an illustration; next, a level of plausibility was allocated to the extracted finding, (b) findings were summarized into categories (i.e., a brief description of a key concept arising from the aggregation of two or more like findings) based on similarity of concepts and (c) synthesized findings (i.e., an overarching description of a group of categorized findings) were derived from categories (22, 27). Category descriptions and synthesized findings were created by a consensus process between three members (HH, TD, DB) of the review team, after repeated reading of the extracted findings.

Patient and public involvement

No patients were involved in the design or conduct of this systematic review.

Patients' experiences with the application of medical adhesives to the skin

RESULTS

Screening and search outcome

The literature search identified 5463 records. No additional records were identified through manual search. After removing duplicates, two reviewers (HH, TD) independently screened the title and abstract of 3102 articles using the software tool Covidence. The eligibility of 160 articles was assessed by screening the full texts. After full text screening 151 studies were excluded. In total, 9 studies were included. The search and selection process is summarized in Figure 1 (28).

Description of included studies



Figure 1: PRISMA flowchart

The included studies were published between 2013 and 2023. Five studies were conducted in the United Kingdom (29-33), and one each in Turkey (34), Brazil (35), Ireland (36) and China (37). Four studies adopted a phenomenological approach (30, 34, 35, 37). Seven studies used semi-structured interviews, in-depth interviews or focus groups.

Various methods for data analysis were employed across these studies. Data collection was conducted either directly from patients or through proxies such as parents, healthcare providers, or informal caregivers. Sample sizes across the studies varied, ranging from 7 to 150 participants. All medical adhesives used in the included studies were wound dressings. Table 1 provides a detailed overview of the study characteristics.

Page | 7

Enseignement Superieur (ABES) Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

Page 9 of 28

BMJ Open Patients' experiences with the application of medical adhesives to the skin

Author (year), coun <u>try</u>	Methodology / design	Aim	Method of data collection	Method of data analysis	Participants	Setting on 1	Experience reported by	Medical adhesive used
Bateman (2015), UK	Product evaluation with a qualitative component	To gain insight into the patient experience, especially in regards to patient choice of product.	Clinicians asking patients one close-ended question and asking them to provide comments to it	No formal data analysis reported (themes were formed from the comments)	Patients who were referred to a wound care service with low to high-exuding wounds (n= 150)	Wound categories service of Ease NHS tess related to t	Patient	CutiMed Siltec B(order) - also CutiMed Siltec and CutiMed siltec Plus were used in this study
Docking et al. (2018), UK	No specific study design is mentioned	To explore the feasibility of the use of analgesic dressings in older adults with leg ulcers, including their perception of current pain management, feasibility of an analgesic dressing, and potential challenges.	Focus group interviews (n= 2)	Framework analysis	Community nurses at the University of Greenwich, who attended a wound care class (n= 15)	Nursiræded from http://bmjopen.t Supertain Univegata mining, Al training	Proxy: Nurses	Not reported
Elliott & Bluebelle Study Group (2017), UK	Mixed-methods research; phase 1 included interviews	To produce a comprehensive list of potential issues relating to wound and dressing experience and practical management issues.	Semi-structured interviews	Coding + method of constant comparison to derive themes from the data	Patients who had undergone, or were scheduled to undergo, an abdominal surgical procedure or caesarean section (n= 39)	Two university- teaching NHS hospitals and three district NHS Hospitals in the South West and Millards regione of 13 England	Patient	Varied between adhesive coverings (absorptive or non-absorptive) and tissue adhesive as a dressing (brands were not reported)
Furness et al. (2019), UK	Small-scale qualitative usability study using a person centered approach	To explore patient and staff perceptions of the impact and usability of active and passive virtual reality during painful dressing changes.	Semi-structured interviews (patients) and focus groups (staff)	Semantic analysis for developing themes + constant comparative analysis	Adult inpatients at the local Burns Unit – individual interviews (n= 5) and qualified nurses – focus group	One local OK burns unit gence Bibliog	Patient and proxy: Nurses	Not reported

BMJ Open Patients' experiences with the application of medical adhesives to the skin

					(n-3)			
Grocott et al. (2013), UK	Qualitative participatory research design	To identify unmet needs within the epidermolysis bullosa population in relation to wound dressings and to translate these needs into design concepts and novel products.	Workshop data enhanced by field notes collected during workshops, visits to participants in their homes or in hospital to observe dressing changes	Brainstorming workshop was to begin the creative and analytic process of formulating innovative design concepts. Findings from these sessions were fed back to the user group through subsequent workshops.	Patients with epidermolysis bullosa (A total of 4 workshops were held with numbers of participants ranging from 6 to 20)	3 ong 3 ong biologic biologic bullos for uses related to text and data minimum bullos for uses related to text and data minimum bullos	Patient and proxy: Informal caregivers and clinical nurse specialists	Participants used a variety of products to hold the dressings in place such as bandages, tapes and elastic hosiery. (brands were not reported)
Probst et al. (2023), Ireland	Qualitative, descriptive design	To describe individuals' experiences for chronic wound- associated pain	Semi-structured interviews (telephone interviews)	Thematic analysis following Braun and Clarke framework	Adults with chronic wounds who experience chronic wound- associated pain (n= 13)	Commung, Al training, a	Patient	'Dressing' and 'VAC dressing' (brands were not reported)
Roma et al. (2021), Brazil	Qualitative, exploratory research	To understand the perception and attitude of parents of newborns admitted to a neonatal unit about their children's pain.	Semi-structured interviews	Thematic analysis	Parents of 15 premature newborn babies with a gestational age of 24 to 36 weeks and chronological age of 8 days to 5 months and 3 days (n= 20)	Neonadology Service (40 beds) of a on Univertity hospitation hospitation hospitation	Proxy: Parents of newborn children	Tape (brands were not reported)
Unver et al. (2018), Turkey	Qualitative, descriptive design (phenomenology)	To describe patients' pain experience, pain-coping skills, and the effect of negative pressure wound therapy- related pain on daily	Semi-structured interviews	Colaizzi's method of phenomenologic al data analysis	Patients receiving Negative Pressure Wound Therapy in the abdominal area for the first time (n= 12)	Surgical ward of a universit hospital c Bi bi ogra	Patient	"Adhesive wrap" with foam dressing underneath (brands were not reported)
Page 9		For peer re	eview only - http://	bmjopen.bmj.com/	/site/about/guideline	phique es.xhtml de		

Page | 9

Page 11 of 28					BMJ Open		njopen- d by co		
1			Patients' experi	iences with the	application of	medical adhesi	ves to the skin		
2							-089 ht, i		
3 4 5			life activities following abdominal surgery.				773 on 7		
6 7 8 9 10 11 12 13 14 15	Wang et al. (2015), China	Qualitative, exploratory design (phenomenology)	To investigate medical workers' understanding of current pain management during dressing among children with burns and their attitudes toward the application of 50% nitrous oxide in pain management.	Semi-structured in-depth interviews	Content analysis and open coding	Doctors and nurses (n=7)	Burn contractor tertian Legenta in Eases related to text and China related to text and	Proxy: Doctors and nurses	Not reported
16 17 18	Table 1	: Characteristics o	of included studies				data mi	1	<u> </u>
19							http ning		
20							, Al		
21							njo trai		
23							ning		
24							g, a		
25							j.co nd s		
26 27							simi		
28							on ,		
29							Jun		
30							e 1: hno		
31							8, 2		
32 33							025 ies.		
34							at at		
35							Age		
36							nce		
37							B		
38							blic		
39 40							ogra		
41							μdε		
42	Page 10						iqu		
43 44			For peer re	eview only - http://	bmjopen.bmj.com	/site/about/guidelir	nes.xhtml de		

Page 12 of 28

Enseignement Superieur (ABES) Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies

Patients' experiences with the application of medical adhesives to the skin

Quality of Studies

The quality appraisal revealed varying degrees of quality among the nine studies included in this analysis (see supplementary file 2 for details). Each of these studies employed suitable methodologies to address their respective research inquiries. However, none of the studies offered a statement regarding the cultural or theoretical background of the researchers, and only one study addressed the potential influence of the researchers on the research outcomes (36). To ensure a comprehensive synthesis of the existing evidence, articles were not excluded based on low quality.

Findings

Patients and health care providers reported that patients experienced pain during dressing removal and dressing changes (30, 32-34, 36, 37). From the 9 included studies, 43 findings were extracted after repeated reading of the text. 24 of the 43 extracted findings were supported by an illustration and were therefore allocated unequivocal or equivocal as level of plausibility. The supported findings were then aggregated into 7 categories, based on similarity in meaning (27). These categories were clustered further into 2 synthesized findings based on similarity of concepts: 'Strategies to alleviate pain during dressing changes' and 'Dressing construction and characteristics'. Table 2 provides an overview of the meta-aggregation of the extracted supported findings.

The category 'Emotional response to pain caused by dressing changes' could not be clustered into any synthesized finding, since a synthesized finding has to consist of at least two categories (22, 27). Current or previous experiences of pain during dressing change can trigger an emotional response in patients. Health care providers described noncompliance with leg ulcer treatment in patients due to anxiety and anticipated pain based on previous painful experiences. *"If you tell them we need to increase their visits they don't like it because obviously they know they're going to get pain ... it kind of puts them off and then they become non-compliant"* (30). Patients reported that distraction by use of virtual reality gave them a sense of control over the situation, which resulted in a decrease in pain during dressing change. *"Something as trivial as a video was actually quite empowering for me because I could take myself away"* (32).

BMJ Open Patients' experiences with the application of medical adhesives to the skin

Finding	Category	Synthesize finding
Patients who were provided anesthesia before debridement and dressing changes reported they did not feel any pain. (UE) (34)	1 Nov	
The majority of participants reported that pain is at its worst during dressing removal and changing. Patients therefore require pain relief that will last beyond the point of removal. (UE) (30)	ember Ensei	
One of the strategies was to take painkillers as prescribed by the physician, even though they sometimes caused some side effects such as stomachache or illusions. (UE) (36)	2024. I Jated t	
Many tissue viability nurses recommend that patients take additional analgesics prior to appointments for dressing changes. (UE) (30)	우 옮겨울gesia is a strategy to 호쇄호viate pain during 교향중sing changes	Sta
Some participants indicated providing recommendations to their care network about research or dressings on managing wound-associated pain. (E) (36)	haded fi	ategies
Raising awareness about chronic wound-associated pain was another recommendation. Some participants highlighted the importance that if a wound patient mentions having pain to immediately refer them to a pain manager. (UE) (36)	om htt ABES)	to allev
Medical workers agree that 50% nitrous oxide is applicable to dressing analgesia for children with burns. (UE) (37)	9;//b	iate p
A key factor in reducing pain and increasing tolerance of wound care seemed to be the degree of distraction created by VR. (UE) (32)	m jopen	vain duri
Patients were unanimous that they had achieved good levels of distraction (and no nausea) in the active VR. Some spoke of awareness of pain and of what the nurses were doing. (UE) (32)	VFus a strategy to alleviate pain during	ng dres
Without this distraction, normal behavior involved being drawn to and focusing on the wound and wound care, which increased pain. Not watching meant reduced pain. (UE) (32)	similar	sing ch
More than 10% of neonates hospitalized in the four units analyzed in the survey, in 2011, did not receive any analgesia in the first three postoperative days. Alisson's speech drew attention to other painful stimuli. (UE) (35)	echnolog	anges
Participants thought there was a large gap between the current situation and their expectations. They expected to perform dressing with children's cooperation under noninvasive analgesia. They expected better measures to reduce the pain during dressing. (UE) (37)	and suffering in children caused by dressing changes	
For the pain suffered by children during dressing of burn wounds, all participants showed sincere sympathy: we provided a score of 0–10 to measure their degree of sympathy. All of them scored 10 (sincere sympathy). (UE) (37)	⊣ gence B	
The main causes of dressing change pain were swift wrap removal and the resulting traumatized skin. (UE) (34)	blic	
^o age 12	ographique	
For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtm	n de	

BMJ Open Patients' experiences with the application of medical adhesives to the skin

Nine participants specified having procedural pain and the pain level was influenced by their activities of daily living. (UE) (36) Dressing removal: "Liust completely soaked it ladbesive dressing) in the shower then my busband just took it off for me. But	Frocedures to remove	
it was, it was really easy. Much easier than I thought.' (Patient, adhesive dressing)". (UE) (31)	ovem Ens	
Atraumatic application and removal, Skin protection, Good adherence with product remaining in place, Comfort of product in place. (E) (29)	to of an	Dres
It is essential that a dressing designed for leg ulcers only impacts on the wounds itself. (UE) (30)		cha
Wound comfort (UE) (31)	town	cons
Reactions to the dressing (UE) (31)	Adverse reactions to the	eristic
Participants noted that the amount of exudate and associated odour and leakage meant dressings required frequent changes, which were painful and time consuming, Also evidenced in the way that pain was described was the 'pain' experienced by the carers. (UE) (33)	data mini	uion and
One of the key problems reported with treating leg ulcers was noncompliance by the patients, often related to their anxiety around anticipated pain. (E) (30)	tp://bm	
Most spoke of positive emotions in response to the VR. The active VR in particular was "fun," "challenging," and "enjoyable" (various pts). Ns1 expressed surprise at participants' apparently pleasurable engagement with the technology. She spoke about the "laughter," an outcome rarely associated with painful dressing changes. (UE) (32)	Engotional response to	
Two described feeling they could control part of the otherwise passive and traumatic dressing change experience when using VR. Having control meant retaining one's "humanity." The sense of having some control over the situation, along with the distraction and reduced pain, helped some patients manage their own emotional responses to the experience. There was a sense of pride in her achievement of self-control in circumstances which could otherwise be experienced as shameful, humiliating, and disempowering. (UE) (32)	n path caused by dressing changes similar on June changes and changes	
UE = unequivocal finding, E = equivocal finding, VR = Virtual Reality	3, 202	
Table 2: Overview of meta-aggregation of the extracted findings.	s. 5 at	
	Agence Bibliograph	
Page 13	ique	
For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtm	del	

Patients' experiences with the application of medical adhesives to the skin

Synthesized findings

Strategies to alleviate pain during dressing changes

The synthesized finding *Strategies to alleviate pain during dressing changes* emerged from four categories: a) 'analgesia is a strategy to alleviate pain during dressing changes', b) 'Virtual Reality (VR) is a strategy to alleviate pain during dressing changes', c) 'strategies to alleviate pain and suffering in children caused by dressing changes' and d) 'procedures to remove dressings' (Table 2).

a) Analgesia is a strategy to alleviate pain during dressing changes

Analgesia and anesthesia were described as strategies to alleviate pain during dressing changes (30, 34, 36, 37). Patients reported that being provided anesthesia before the dressing changes reduced the experienced pain. "On the first changing, they made me sleepy (with narcotics) and I didn't feel anything then the wraps were taken off the skin. They didn't anaesthetize me the second time, and it was much worse" (34). Health care providers similarly recommended patients to take additional analgesics prior to dressing change appointments in order to reduce pain during dressing (30, 36, 37), even though they sometimes triggered side effects (36). Some patients gave recommendations about research on dressings or pain management to their care network. "Olivia suggested focusing research on pain relieving dressings rather than drugs". Some also indicated the importance of timely referral to a pain manager (36).

b) Virtual Reality (VR) is a strategy to alleviate pain during dressing changes

Additionally, utilizing virtual reality (VR) was described as a strategy to alleviate pain during dressing changes. The use of VR distracted patients from focusing on the wound care and accompanying pain during dressing change. *"Before you were thinking, it hurts, because watching them do it makes it worse"* (32).

c) Strategies to alleviate pain and suffering in children caused by dressing changes

Parents and health care providers reported pain and suffering in neonates and children during dressing change (35, 37). "The day I most saw her crying in pain was when she removed the tape" (35). Even though pain during dressing change is a known problem, health care providers reported a gap between the current situation and their expectations regarding strategies to alleviate pain during dressing change in children. Patients received too little or even no pain relief (35, 37). "Analgesics available for children are quite few, children with burns cry all the time during the dressing, and we need available drugs or methods to relieve their pain" (37).

d) Procedures to remove dressings

Specific procedures for removal of dressings were described (31, 34). Unver et al. (2018) reported that swift removal of adhesives and the resulting skin trauma were the main causes of pain during dressing changes. Patients soaked the adhesive dressings in the shower to aid dressing removal and reduce removal pain. *"I just completely soaked it [adhesive dressing] in the shower then my husband just took it off for me. But it was, it was really easy. Much easier than I thought"* (31). Patients experienced procedural pain and indicated that activities of the daily living influenced pain levels. *"Maybe sometimes with dressing changes, the worst pain I had was with the VAC dressing (Negative Pressure Wound Therapy)"* (36).

Enseignement Superieur (ABES) Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

Enseignement Superieur (ABES) Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies.

Patients' experiences with the application of medical adhesives to the skin

Dressing construction and characteristics

The two categories a) 'characteristics of an atraumatic dressing' and b) 'adverse reactions to the dressing' have been synthesized on the basis that they both describe the constitution of the dressings used in the studies. This synthesized finding demonstrates that dressings should be designed in a way that facilitates easy removal and minimizes discomfort during wear.

a) Characteristics of an atraumatic dressing

Atraumatic application and removal were described as a characteristic of an atraumatic dressing. "Those dressings helped my mum's legs in that they didn't hurt here when the nurse took them off" (29). Additionally, skin protection of the peri-wound skin, good adherence, and comfort during wear of the adhesive dressing were highlighted as features of atraumatic dressings. "Very important not to have them stuck on the area that has just been healed, and it is very difficult to take it off without hurting the wound again, and I think that is terribly important" (29, 30).

b) Adverse reactions to the dressing

To minimize discomfort during dressing wear, potential adverse reactions to dressings must be considered when choosing an adhesive dressing. Frequent dressing changes due to leakages caused by highly exudating wounds, were reported as very painful. "*It is excruciating when the dressings keep coming on and off and she is in unbearable pain (reported by carer)*" (33). Itching and allergic reactions to the adhesives used were also described as uncomfortable adverse reactions to an adhesive dressing. "*I've now got really itchy where the plaster goes. Which is uncomfortable*" (31).

DISCUSSION

This systematic review aimed to synthesize patients' experiences with the application of medical adhesives to the skin. This systematic literature search only retrieved studies that included findings on wound dressings. No records reporting patients' experiences with other types of medical adhesives such as electrocardiography (ECG) electrodes, intravenous (IV) catheter patches, securement for medical devices, ostomy supplies et cetera were identified. All included studies in this review reported experiences with the changing and removal of dressings. No findings described patient experiences with the application and wear of adhesive dressing.

The results imply that patients experience pain and discomfort during dressing change and removal (30, 32-34, 37). Awareness among health care providers is important since a single painful experience can change nociceptive pathways and induce sensitization. This is a process that involves a reduction in the threshold of activation and an increased response rate to damaging stimulation (38, 39). Pain is a personal experience, influenced by biological, psychological and social factors to varying degrees (13). Some patient factors associated with experiencing high-intensity pain during wound care procedures include being of younger age, female, non-white, having chronic pain conditions, being opioid tolerant, having anxiety or depression, pain catastrophizing and high anticipatory pain (40). Pain catastrophizing is measured by using "The pain catastrophizing scale" and the term is frequently used since the

Page | 15

Patients' experiences with the application of medical adhesives to the skin

factors included in the measurements are a comprehensive predictor of pain. However, this term is controversial since people with chronic pain have reacted negatively towards it as the term diminishes the importance of the medical reason behind their pain and focuses too much on psychological factors, which in the end can lead to insufficient care (41). Through the use of neurological imaging, cortical and sub cortical pathways have been identified that are activated when the patient expects pain. This is called anticipatory pain (Woo, 2008). Patients experiencing anxiety in relation to anticipatory pain can develop a reduced pain tolerance and lead to an increased self-reported pain intensity, resulting in more painful future procedures (40, 42, 43).

Along with describing experiences, patients and proxies describe the need for strategies to alleviate the pain and discomfort experienced during the application of medical adhesives to the skin (30-32, 34, 35, 37). Both pharmacological and nonpharmacological interventions to alleviate adhesive-related pain were described. Health care professionals describe the lack of an appropriate analgesic regimen for the neonates needing their burn wounds dressed (37). Many infants get to little or no pain relieving interventions despite the existence of validated pain assessment tools and recommended actions for pain management when conducting medical procedures. The recommendation for neonates is both pharmacological measures, such as acetaminophen, opioids and local topical agents, and non-pharmacological measures, such as breastfeeding, skin-to-skin contact and sucrose solution together with non-nutritive sucking (44). In addition, distraction by virtual reality was described as a non-pharmacological intervention to reduce dressing change-related pain (32). Immersive virtual reality has been demonstrated to alleviate pain across various medical procedures, including dressing changes in patients with hand injuries (45). For patients to take prescribed analgesics before dressing changes and for nurses to recommend patients to take analgesics before dressing changes was also part of the synthesised finding (30, 36). Recommended pharmacological strategies for treating pain, for breakout pain for example when changing dressings, are increasing the dose of the analgesic already prescribed, adding another quicker pain medication or reducing the time in between doses (46).

Health professionals should improve their communication with patients about the risks related to medical adhesive use. They should try to minimize pain during adhesive removal and the occurrence of medical adhesive-related skin injuries (7). It is important for health professionals to understand the unique characteristics of a medical adhesive for informed decision-making regarding the selection of the adhesive with the unique characteristics of that medical adhesive in mind (47). Dressing characteristics for atraumatic dressing removal were described in a few studies (29-33). Patients with atraumatic dressings using a silicone contact layer applied to their skin report significantly lower pain scores (p < 0.01) when compared to traditional adhesives (i.e. adhesive foams, hydrocolloids and other dressings) (48). It is also important for health professionals to have knowledge about the skin as well as knowledge about application and removal techniques for medical adhesives to prevent unnecessary damage to the patient (47). The barrier function of the skin can be damaged, as a result of single or repeated application of medical adhesives, despite a reduction in adhesive strength during prolonged dressing wear (49).

Methodological considerations

Page 18 of 28

Enseignement Superieur (ABES) Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

This review used meta-aggregation to synthesize the findings. No member of the research team had previous experience with this data synthesis method. Therefore, meta-aggregation was performed independently by two members of the research team (HH, TD). Extracted findings were synthesized to a higher level of abstraction until consensus was reached. When necessary, a third member of the research team (DB) was consulted.

Strengths and limitations

The systematic review only included studies containing gualitative data to explore patients' experiences with the application of medical adhesives to the skin, which resulted in only eight eligible studies. Employing quantitative studies in addition to gualitative articles might have provided interesting insights on pain and discomfort scores of patients while medical adhesives are being removed. However, conducting a mixed-method review has several limitations. , including difficulties of comparing results from these different paradigms is difficult and extends the time to complete the review (50).

The study characteristics of the included studies, such as age, setting and country, were heterogeneous. Since only a limited amount of findings could be extracted, it was not possible to identify potential cultural differences in the reported findings.

Studies that were published in languages other than English, Swedish, Dutch, Norwegian, Danish or German were not screened through the search strategy. This may have led to exclusion of relevant articles published in another language.

Four of the included studies (30, 32, 34, 37) did not specify the used dressing type or brand. No additional information on adhesive type or brand was retrieved by contacting the authors. Therefore, the results of this systematic review may contain findings that are not related to medical adhesives.

This systematic review describes patients' experiences with the application of dressings on various wound types: burn wounds (32, 37), chronic leg ulcers (30), surgical wounds (31, 34) and epidermolysis bullosa (33). Pain can also be caused by tissue damage (51). Reported experiences of pain and discomfort with the application of medical adhesives to the skin might consequently be obscured by wound pain (36, 52).

Implications for research and clinical practice

Future research should focus on exploring routines to reduce unwanted side effects with medical adhesive use in clinical practice. This will guide improvement of adhesive technologies and raise awareness among healthcare professionals regarding the pain and discomfort related to medical adhesives application to the skin.

There is a need to raise awareness among healthcare professionals regarding the pain and discomfort related to the application of medical adhesives to the skin. This can be done through an educational effort as well as raising awareness on a higher level in the healthcare system, for example questioning the materials being bought for hospital wide use. When money is the deciding factor, are different brands equal in regards of adhesion, protection of the skin etc.?

Patients' experiences with the application of medical adhesives to the skin

Future research should focus on enhancing both routines and technologies, with a particular emphasis on advancing skin-friendly adhesives to reduce unwanted side effects. Interviewing patients about their experiences and doing a narrative description of specific aspects of the dressing change process could be of value. Future research should explore patient experiences with other types of medical adhesives (ECG electrodes, IV patches, et cetera).

In some cases, there will be a need for medical adhesives that adhere more strongly to the skin to prevent dislocation of life-saving medical devices such endotracheal tubes and intravenous catheters in an intensive care setting. Future studies should explore new material development by focusing on cell biology, material development and intelligent technologies (53).

CONCLUSION

The meta-aggregation performed in this study implies that patients do experience pain and discomfort when wound dressings are changed or removed. The synthesized findings of this review 'strategies to alleviate pain during dressing changes' and 'dressing construction and characteristics' can serve as a guide to improve clinical routines for medical adhesives use, avoid pain and discomfort while changing medical adhesives (4, 5) and prevent emotional trauma and post-traumatic stress in children (10, 11).

Footnotes

AUTHOR CONTRIBUTIONS

HH and TD contributed equally to this paper. All authors contributed to the conception of the research question and the writing of the protocol. HH, DB, SJ, JK, LMK, and ME contributed to the development of search strategies, eligibility criteria, and methodology for data synthesis. All authors contributed to the draft protocol and approved the final version of this protocol. HH, TD, and ME worked in duplicate to review the titles and abstracts of all materials obtained using the search strategy to exclude articles that do not meet the eligibility criteria. HH and TD evaluated potentially eligible studies through full-text screening and excluded non-eligible studies, documenting the reason for exclusion. HH and TD independently extracted data from the included studies. ME and DB checked the quality on 20% of the extracted data of the included articles. HH and TD synthesized the data and drafted the manuscript. All authors read, provided feedback, and approved the final manuscript.

ACKNOWLEDGEMENTS

Mölnlycke Health Care AB provided financial support to conduct this systematic review. We would also like to thank Samal Al Gilani, RN, PhD, for participating in the planning of the project and in some additional screening.

Enseignement Superieur (ABES) Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies

Patients' experiences with the application of medical adhesives to the skin

CONFLICT OF INTEREST

None.

FUNDING SOURCES

This systematic review is supported by Mölnlycke Health Care AB. Mölnlycke Health Care AB was not involved in any other aspect than the funding of this systematic review. The funder had no input on the interpretation or publication of the study results.

for perteries only

Page | 19

Patients' experiences with the application of medical adhesives to the skin

References

1. Medical device adhesives, sealants and coatings for the medical device industry 2024 [Available from: https://www.medicaldevice-network.com/buyers-guide/medical-adhesives/.

2. McNichol L, Lund C, Rosen T, Gray M. Medical adhesives and patient safety: state of the science: consensus statements for the assessment, prevention, and treatment of adhesive-related skin injuries. Orthop Nurs. 2013;32(5):267-81.

3. Farris MK, Petty M, Hamilton J, Walters SA, Flynn MA. Medical Adhesive-Related Skin Injury Prevalence Among Adult Acute Care Patients: A Single-Center Observational Study. J Wound Ostomy Continence Nurs. 2015;42(6):589-98.

4. Kammerlander G, Eberlein T. Nurses' views about pain and trauma at dressing changes: a central European perspective. J Wound Care. 2002;11(2):76-9.

5. Hollinworth H, Collier M. Nurses' views about pain and trauma at dressing changes: results of a national survey. J Wound Care. 2000;9(8):369-73.

6. Woo KY. Unravelling nocebo effect: the mediating effect of anxiety between anticipation and pain at wound dressing change. Journal of clinical nursing. 2015;24(13-14):1975-84.

7. Fumarola S, Allaway R, Callaghan R, Collier M, Downie F, Geraghty J, et al. Overlooked and underestimated: medical adhesive-related skin injuries. Journal of wound care. 2020;29(Sup3c):S1-S24.

8. Matsuzaki K, Upton D. Wound treatment and pain management: a stressful time. Int Wound J. 2013;10(6):638-44.

9. Reevell G, Anders T, Morgan T. Improving patients' experience of dressing removal in practice. Journal of Community Nursing. 2016;30(5).

10. Hildenbrand AK, Marsac ML, Daly BP, Chute D, Kassam-Adams N. Acute Pain and Posttraumatic Stress After Pediatric Injury. J Pediatr Psychol. 2016;41(1):98-107.

11. Holley AL, Wilson AC, Noel M, Palermo TM. Post-traumatic stress symptoms in children and adolescents with chronic pain: A topical review of the literature and a proposed framework for future research. Eur J Pain. 2016;20(9):1371-83.

12. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders 5ed. Arlington, USA: American Psychiatric Publishing; 2013.

13. Raja SN, Carr DB, Cohen M, Finnerup NB, Flor H, Gibson S, et al. The revised International Association for the Study of Pain definition of pain: concepts, challenges, and compromises. Pain. 2020;161(9):1976-82.

14. Werner M, Leden I. Smärta och smärtbehandling: Liber; 2010.

15. Bianchi J. Protecting the integrity of the periwound skin. Wound Essentials. 2012;1:58-64.

16. Collier M. Minimising pain and medical adhesive related skin injuries in vulnerable patients. British Journal of Nursing. 2019;28(15):S26-S32.

17. Kim JY, Kim NK, Lee YJ. A descriptive study of Korean nurses' perception of pain and skin tearing at dressing change. Int Wound J. 2016;13 Suppl 1(Suppl 1):47-51.

18. August DL, New K, Ray RA, Kandasamy Y. Frequency, location and risk factors of neonatal skin injuries from mechanical forces of pressure, friction, shear and stripping: a systematic literature review. Journal of Neonatal Nursing. 2018;24(4):173-80.

19. Cutting K. Impact of adhesive surgical tape and wound dressings on the skin, with reference to skin stripping. Journal of Wound Care. 2008;17(4):157-62.

20. Jones L, Bell D, Hodgson C, Mohamud L, Stephan-Haynes J, Callaghan R, et al. Case study series: Lifteez aerosol and wipes for the prevention and management of MARSI. Wounds UK. 2018;14(5).

Page | 20

Enseignement Superieur (ABES) Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

BMJ Open

Patients' experiences with the application of medical adhesives to the skin

Tong A. Flemming K. McInnes E, Oliver S, Craig J. Enhancing transparency 21. in reporting the synthesis of qualitative research: ENTREQ. BMC Med Res Methodol. 2012;12:181.

22. Lockwood C, Porritt K, Munn Z, Rittenmeyer L, Salmond S, Bjerrum M, et al. Chapter 3: systematic reviews of gualitative evidence. Aromataris E LC, Porritt K, Pilla B, Jordan Z, editor: Joanna Briggs Institute; 2024.

Hofman H, Beeckman D, Duljic T, Al Gilani S, Johansson S, Kottner J, et al. 23. Patients' experiences with the application of medical adhesives to the skin: a gualitative systematic review protocol. BMJ Open. 2023;13(6):e073546.

Karp JM, Langer R. Dry solution to a sticky problem. Nature. 24.

2011;477(7362):42-3.

Zulkowski K. Understanding moisture-associated skin damage, medical 25. adhesive-related skin injuries, and skin tears. Advances in skin & wound care. 2017;30(8):372-81.

26. Hwang I, Kim HN, Seong M, Lee SH, Kang M, Yi H, et al. Multifunctional smart skin adhesive patches for advanced health care. Advanced healthcare materials. 2018;7(15):1800275.

Lockwood C, Munn Z, Porritt K. Qualitative research synthesis: 27. methodological guidance for systematic reviewers utilizing meta-aggregation. JBI Evidence Implementation. 2015;13(3):179-87.

Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et 28. al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. Bmi. 2021:372:n71.

Bateman SD. 150 patient experiences with a soft silicone foam dressing. Br J 29. Nurs. 2015;24(12):S16, s8-23.

Docking R, Boateng J, Catanzano O, Schofield P. A Preliminary Study of Pain 30. Relieving Dressings for Older Adults With Chronic Leg Ulcers From the Provider's Perspective: A Qualitative Study. J Pain Palliat Care Pharmacother. 2018;32(2-3):71-81.

31. Elliott D, The Bluebelle Study Group. Developing outcome measures assessing wound management and patient experience: a mixed methods study. BMJ Open. 2017;7(11):e016155.

32. Furness PJ, Phelan I, Babiker NT, Fehily O, Lindley SA, Thompson AR. Reducing Pain During Wound Dressings in Burn Care Using Virtual Reality: A Study of Perceived Impact and Usability With Patients and Nurses. J Burn Care Res. 2019;40(6):878-85.

Grocott P, Blackwell R, Weir H, Pillay E. Living in dressings and bandages: 33. findings from workshops with people with Epidermolysis bullosa. Int Wound J. 2013;10(3):274-84.

Unver S, Eyi S, Ozkan ZK. A Descriptive, Qualitative Study to Explore the 34. Pain Experience During Negative Pressure Wound Therapy for Postsurgical Abdominal Wounds. Ostomy Wound Manage. 2018;64(12):38-48.

Roma TM, Carvalho Lam Z, Garcia Marques AC, Uchoa Lopes Pereira M, 35. Motta E, Lamy-Filho F. Perception and attitude of parents towards newborn pain in neonatal unit. Revista de Pesquisa: Cuidado e Fundamental. 2021;13(1).

36. Probst S, Gschwind G, Murphy L, Sezgin D, Carr P, McIntosh C, et al. Patients 'acceptance' of chronic wound-associated pain - A qualitative descriptive study. J Tissue Viability. 2023;32(4):455-9.

Wang HX, Li YX, Zhou RZ, Zhao JJ. Medical workers' cognition of using 50% 37. nitrous oxide in children with burns: a qualitative study. Burns. 2015;41(6):1275-80. Di Maio G, Villano I, Ilardi CR, Messina A, Monda V, Iodice AC, et al. 38. Mechanisms of Transmission and Processing of Pain: A Narrative Review. Int J Environ Res Public Health. 2023;20(4).

Page | 21

1 2 3

4

5

6

7

8

9

10

11

12

13

17

19

21

23

24

25

27

31

34

35

37

41

43

45

47

48

49

51

54

55

57

BMJ Open

Patients' experiences with the application of medical adhesives to the skin

39. Li W, Gong Y, Liu J, Guo Y, Tang H, Qin S, et al. Peripheral and Central Pathological Mechanisms of Chronic Low Back Pain: A Narrative Review. J Pain Res. 2021;14:1483-94.

40. Gardner SE, Abbott LI, Fiala CA, Rakel BA. Factors associated with high pain intensity during wound care procedures: A model. Wound Repair Regen. 2017;25(4):558-63.

41. Sullivan MJL, Tripp DA. Pain Catastrophizing: Controversies, Misconceptions and Future Directions. J Pain. 2024;25(3):575-87.

42. Feeney SL. The relationship between pain and negative affect in older adults: anxiety as a predictor of pain. J Anxiety Disord. 2004;18(6):733-44.

43. Woo KY. Meeting the challenges of wound-associated pain: anticipatory pain, anxiety, stress, and wound healing. Ostomy Wound Manage. 2008;54(9):10-2.

44. Campbell-Yeo M, Eriksson M, Benoit B. Assessment and Management of Pain in Preterm Infants: A Practice Update. Children (Basel). 2022;9(2).

45. Teh JJ, Pascoe DJ, Hafeji S, Parchure R, Koczoski A, Rimmer MP, et al. Efficacy of virtual reality for pain relief in medical procedures: a systematic review and meta-analysis. BMC Med. 2024;22(1):64.

46. Bechert K, Abraham SE. Pain management and wound care. J Am Col Certif Wound Spec. 2009;1(2):65-71.

47. Downie F, Allaway R. Preventing Medical Adhesive Related Skin Injury (MARSI): introducing a skincare regimen for good practice. Wounds. 2024;20(1):38.
48. White R. A multinational survey of the assessment of pain when removing dressings. Wounds uK. 2008;4(1):14.

49. Mbithi F, Worsley PR. Adhesives for medical application - Peel strength testing and evaluation of biophysical skin response. J Mech Behav Biomed Mater. 2023;148:106168.

50. Whitley GA, Munro S, Hemingway P, Law GR, Siriwardena AN, Cooke D, et al. Mixed methods in pre-hospital research: understanding complex clinical problems. Br Paramed J. 2020;5(3):44-51.

51. Shubayev VI, Kato K, Myers RR. Frontiers in Neuroscience

Cytokines in Pain. In: Kruger L, Light AR, editors. Translational Pain Research: From Mouse to Man. Boca Raton (FL): CRC Press/Taylor & Francis

Copyright © 2010 by Taylor and Francis Group, LLC.; 2010.

52. Gardner SE, Bae J, Ahmed BH, Abbott LI, Wolf JS, Hein M, et al. A clinical tool to predict severe pain during wound dressing changes. Pain. 2022;163(9):1716-27.

53. Su L, Jia Y, Fu L, Guo K, Xie S. The emerging progress on wound dressings and their application in clinic wound management. Heliyon. 2023;9(12):e22520.

				BMJ Open		jopen-2024-089 [.] by copyright, ir		
Author (year), country	Methodology / design	Aim	Method of data collection	Method of data analysis	Participants	Setting on 1	Experience reported by	Medical adhesive used
Bateman (2015), UK	Product evaluation with a qualitative component	To gain insight into the patient experience, especially in regards to patient choice of product.	Clinicians asking patients one close-ended question and asking them to provide comments to it	No formal data analysis reported (themes were formed from the comments)	Patients who were referred to a wound care service with low to high-exuding wounds (n= 150)	Wound cate services NHS telested to	Patient	CutiMed Siltec B(order) - also CutiMed Siltec and CutiMed siltec Plus were used in this study
Docking et al. (2018), UK	No specific study design is mentioned	To explore the feasibility of the use of analgesic dressings in older adults with leg ulcers, including their perception of current pain management, feasibility of an analgesic dressing, and potential challenges.	Focus group interviews (n= 2)	Framework analysis	Community nurses at the University of Greenwich, who attended a wound care class (n= 15)	Nursing Supertain Unive data mining, AI training	Proxy: Nurses	Not reported
Elliott & Bluebelle Study Group (2017), UK	Mixed-methods research; phase 1 included interviews	To produce a comprehensive list of potential issues relating to wound and dressing experience and practical management issues.	Semi-structured interviews	Coding + method of constant comparison to derive themes from the data	Patients who had undergone, or were scheduled to undergo, an abdominal surgical procedure or caesarean section (n= 39)	Two university- teaching NHS hospitals and three estrict NHS Respitals in the South West and Mellards regions of 13 Englaged	Patient	Varied between adhesive coverings (absorptive or non-absorptive) and tissue adhesive as a dressing (brands were not reported)
Furness et al. (2019), UK	Small-scale qualitative usability study using a person centered approach	To explore patient and staff perceptions of the impact and usability of active and passive virtual reality during painful dressing changes.	Semi-structured interviews (patients) and focus groups (staff)	Semantic analysis for developing themes + constant comparative analysis	Adult inpatients at the local Burns Unit – individual interviews (n= 5) and qualified nurses – focus group	One local BK burns unit gence Bibliog	Patient and proxy: Nurses	Not reported

Page	25	of	28
------	----	----	----

				1		24-0897 ight, inc	1	
Grocott et al. (2013), UK	Qualitative participatory research design	To identify unmet needs within the epidermolysis bullosa population in relation to wound dressings and to translate these needs into design concepts and novel products.	Workshop data enhanced by field notes collected during workshops, visits to participants in their homes or in hospital to observe dressing changes	Brainstorming workshop was to begin the creative and analytic process of formulating innovative design concepts. Findings from these sessions were fed back to the user group through subsequent workshops.	(n= 3) Patients with epidermolysis bullosa (A total of 4 workshops were held with numbers of participants ranging from 6 to 20)	73 onig 73 onig 73 onig November 2024. Downloaded from I Hospide bullos bullos ruses related to text and data min	Patient and proxy: Informal caregivers and clinical nurse specialists	Participants us a variety of products to ho the dressings place such as bandages, tap and elastic hosiery. (brands were reported)
Probst et al. (2023), Ireland	Qualitative, descriptive design	To describe individuals' experiences for chronic wound- associated pain	Semi-structured interviews (telephone interviews)	Thematic analysis following Braun and Clarke framework	Adults with chronic wounds who experience chronic wound- associated pain (n= 13)	Commig, Al training, a	Patient	'Dressing' and 'VAC dressing (brands were reported)
Roma et al. (2021), Brazil	Qualitative, exploratory research	To understand the perception and attitude of parents of newborns admitted to a neonatal unit about their children's pain.	Semi-structured interviews	Thematic analysis	Parents of 15 premature newborn babies with a gestational age of 24 to 36 weeks and chronological age of 8 days to 5 months and 3 days (n= 20)	Neonadology Service (40 beds) af a Univertity hospitation hospitat	Proxy: Parents of newborn children	Tape (brands were reported)
Unver et al. (2018), Turkey	Qualitative, descriptive design (phenomenology)	To describe patients' pain experience, pain-coping skills, and the effect of negative pressure wound therapy- related pain on daily	Semi-structured interviews	Colaizzi's method of phenomenologic al data analysis	Patients receiving Negative Pressure Wound Therapy in the abdominal area for the first time (n= 12)	Surgical ward of a universit hospital c Biblio gr	Patient	"Adhesive wra with foam dressing underneath (brands were reported)

BMJ Open

d by copyrigh njopen-2024-(

						l, ir		
		life activities following abdominal surgery.				773 on 1 ncluding		
Wang et al. (2015), China	Qualitative, exploratory design (phenomenology)	To investigate medical workers' understanding of current pain management during dressing among children with burns and their attitudes toward the application of 50% nitrous oxide in pain management.	Semi-structured in-depth interviews	Content analysis and open coding	Doctors and nurses (n=7)	Burn contended tertian those in Ease China seignement Superieur china to text and da	Proxy: Doctors and nurses	Not reported
Table 1.	: Characteristics c	of included studies				rom http://bmjope ABES) . a mining, Al traini		
						n.bmj.com/ on Ju ng, and similar te		
						ne 13, 2025 at Aç chnologies.		
						yence Bibliograp		
		For peer re	eview only - http://	bmjopen.bmj.com/	/site/about/guideline	es.xhtml de		

Page	27	of	28
------	----	----	----

	BMJ Open	by copyright, in	open-2024-0897	
	Finding	cludii	Category	Synthesi findin
Patients who were provided anesthesia (34)	pefore debridement and dressing changes reported they did not feel any pain. (U	E) for L		
The majority of participants reported tha require pain relief that will last beyond th	pain is at its worst during dressing removal and changing. Patients therefore e point of removal. (UE) (30)	ISES TE	ember	
One of the strategies was to take painkil effects such as stomachache or illusions	ers as prescribed by the physician, even though they sometimes caused some si . (UE) (36)	de de to	2024. [
Many tissue viability nurses recommend (UE) (30)	that patients take additional analgesics prior to appointments for dressing change	es. text a	Anolgesia is a strategy to	St
Some participants indicated providing re wound-associated pain. (E) (36)	commendations to their care network about research or dressings on managing	nd data	aded fr	trategie
Raising awareness about chronic wound importance that if a wound patient menti	-associated pain was another recommendation. Some participants highlighted thoons having pain to immediately refer them to a pain manager. (UE) (36)	n minin	a mention	s to alle
Medical workers agree that 50% nitrous	oxide is applicable to dressing analgesia for children with burns. (UE) (37)	 	p://br	viate
A key factor in reducing pain and increas (UE) (32)	sing tolerance of wound care seemed to be the degree of distraction created by V	R. ainin	-trainin	pain du
Patients were unanimous that they had a awareness of pain and of what the nurse	achieved good levels of distraction (and no nausea) in the active VR. Some spoke s were doing. (UE) (32)	e of and	/ Bis a strategy to alleviate pain during	ring dre
Without this distraction, normal behavior increased pain. Not watching meant red	involved being drawn to and focusing on the wound and wound care, which uced pain. (UE) (32)	similar	on	essing c
More than 10% of neonates hospitalized the first three postoperative days. Alisson's speech drew attention to other	in the four units analyzed in the survey, in 2011, did not receive any analgesia in painful stimuli. (UE) (35)	technolog	June 13, 2	changes
Participants thought there was a large gadressing with children's cooperation und dressing. (UE) (37)	ap between the current situation and their expectations. They expected to perforn er noninvasive analgesia. They expected better measures to reduce the pain duri		Strategies to alleviate pain and suffering in children cates by dressing changes	
For the pain suffered by children during score of 0–10 to measure their degree of	dressing of burn wounds, all participants showed sincere sympathy: we provided f sympathy. All of them scored 10 (sincere sympathy). (UE) (37)	a	ence B	
The main causes of dressing change pa	n were swift wrap removal and the resulting traumatized skin. (UE) (34)		ipliog	
	For poor roviow only http://bmichon.hmi.com/site/about/avidalia.com/	atral	raphique d	

BMJ Open	jopen-2024 by copyrig	Page
Nine participants specified having procedural pain and the pain level was influenced by their activities of daily living. (UE) (36) Dressing removal: "I just completely soaked it [adhesive dressing] in the shower then my husband just took it off for me. But it was it was really easy. Much easier than I thought ' (Patient, adhesive dressing)" (UE) (31)	ht, in Cluding Procedures to remove	
Atraumatic application and removal, Skin protection, Good adherence with product remaining in place, Comfort of product in place. (E) (29)	E A A A A A A A A A A A A A A A A A A A	Dressi
Wound comfort (UE) (31) Reactions to the dressing (UE) (31)	4. Downle nent Sup	ng constru
Participants noted that the amount of exudate and associated odour and leakage meant dressings required frequent changes, which were painful and time consuming, Also evidenced in the way that pain was described was the 'pain' experienced by the carers. (UE) (33)	Acceleration to the Acceleration to the	uction and stics
One of the key problems reported with treating leg ulcers was noncompliance by the patients, often related to their anxiety around anticipated pain. (E) (30) Most spoke of positive emotions in response to the VR. The active VR in particular was "fun," "challenging," and "enjoyable" (various pts). Ns1 expressed surprise at participants' apparently pleasurable engagement with the technology. She spoke about the "laughter," an outcome rarely associated with painful dressing changes. (UE) (32) Two described feeling they could control part of the otherwise passive and traumatic dressing change experience when using VR. Having control meant retaining one's "humanity." The sense of having some control over the situation, along with the distraction and reduced pain, helped some patients manage their own emotional responses to the experience. There was a sense of pride in her achievement of self-control in circumstances which could otherwise be experienced as shameful, humiliating, and disempowering. (UE) (32)	;); ;); ;); ;); ;); ;); ;); ;); ;); ;);	1
UE = unequivocal finding, E = equivocal finding, VR = Virtual Reality Table 2: Overview of meta-aggregation of the extracted findings.	ร 13, 2025 at Agence Bibliograp คologies.	
For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtr	bhique de l	





29 of 28 BMJ Open PRISMA 2020 flow diagram for new systematic reviews which included searches of databases, registers and other sourges 24

For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml

de

BMJ Open

BMJ Open

Patients' experiences with the application of medical adhesives to the skin: a qualitative systematic review

Journal:	BMJ Open
Manuscript ID	bmjopen-2024-089773.R1
Article Type:	Original research
Date Submitted by the Author:	06-Sep-2024
Complete List of Authors:	Hofman, Hannelore; Ghent University Faculty of Medicine and Health Sciences, Department of Public Health and Primary Care, University Centre for Nursing and Midwifery Duljic, Tanja; Orebro universitet, Faculty of Medicine and Health Sciences, School of Health Sciences; Orebro universitet, Faculty of Medicine and Health Sciences, School of Health Sciences, Swedish Centre for Skin and Wound Research Johansson, Sara; Creative Mammals Kottner, Jan; Charite - Universitatsmedizin Berlin, Institute of Clinical Nursing Science, Charité Center for Health and Human Sciences Kinnaer, Lise-Marie; Ghent University, Faculty of Medicine and Health Sciences, Department of Public Health and Primary Care, University Centre for Nursing and Midwifery Beeckman, Dimitri; Ghent University Faculty of Medicine and Health Sciences, Department of Public Health and Primary Care, University Centre for Nursing and Midwifery Beeckman, Dimitri; Ghent University Faculty of Medicine and Health Sciences, Department of Public Health and Primary Care, University Centre for Nursing and Midwifery; Orebro universitet, Faculty of Medicine and Health Sciences, School of Health Sciences, Swedish Centre for Skin and Wound Research Eriksson, Mats; Orebro universitet, Faculty of Medicine and Health Sciences, School of Health Sciences
Primary Subject Heading :	Nursing
Secondary Subject Heading:	Qualitative research, Dermatology
Keywords:	Systematic Review, PAIN MANAGEMENT, Patients

SCHOLARONE[™] Manuscripts



I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our <u>licence</u>.

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which <u>Creative Commons</u> licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

terez oni

Enseignement Superieur (ABES) Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies



Enseignement Superieur (ABES) Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

Patients' experiences with the application of medical adhesives to the skin

2
3
4
5
6
6
7
8
0
10
10
11
12
12
1.5
14
15
16
17
10
18
19
20
21
21
22
23
24
25
20
20
27
28
29
20
30
31
32
33
24
34
35
36
37
20
38
39
40
41
/1 /1
42
43
44
45
10
40
47
48
49
50
50
51
52
53
51
54
55
56
57
58
50
59

1

1 Title page

2 3 **TITLE**

4

5 Patients' experiences with the application of medical adhesives to the skin: a qualitative
 6 systematic review
 7

8 AUTHORS

10 Hannelore Hofman^{1,\$}, Tanja Duljic^{2, 3, \$}, Sara Johansson⁴, Jan Kottner⁵, Lise-Marie 11 Kinnaer¹, Dimitri Beeckman^{1,2}, Mats Eriksson^{3, *}

12 13

9

14 **AFFILIATIONS**

15

¹⁶ ¹ University Centre for Nursing and Midwifery, Department of Public Health and Primary
¹⁷ Care, Faculty of Medicine and Health Sciences, Ghent University, Ghent, Belgium
¹⁸ ² Swedish Centre for Skin and Wound Research (SCENTR), Faculty of Medicine and
¹⁹ Health, School of Health Sciences, Örebro University, Örebro, Sweden
²⁰ ³ Faculty of Medicine and Health, School of Health Sciences, Örebro University, Örebro,
²¹ Sweden
²² ⁴ Creative Mammals, Gothenburg, Sweden
²³ ⁵ Institute of Clinical Nursing Science, Charité Center for Health and Human Sciences,

24 Charité-Universitätsmedizin, Berlin, Germany

25 26

27 CORRESPONDING AUTHOR

28

29 *Mats Eriksson, Örebro University, Faculty of Medicine and Health, School of Health

30 Sciences, Fakultetsgatan 1, SE-701 82 Örebro, Sweden

31 Email: mats.h.eriksson@oru.se

32

33

34 OTHER AUTHOR FOOTNOTES

35

³⁶ ^{\$}Hannelore Hofman and Tanja Duljic made equal contributions to this manuscript (joint
 ³⁷ first authorship)

38

39

40 KEYWORDS

41

42 Adhesives; Discomfort; Meta-Aggregation; Pain; Patient Experiences; Skin; Systematic43 Review

44

45

46 WORD COUNT

47

60

48 4.553 words

Page | 1

Patients' experiences with the application of medical adhesives to the skin

49 Abstract

OBJECTIVES

Medical adhesives provide securement of medical devices, facilitate skin protection and allow noninvasive monitoring. Application and removal of medical adhesives can result in pain, dermatitis, trauma or other skin lesions. Understanding patients' experiences when subjected to medical adhesives will contribute to the improvement of clinical routines and the development and improvement of new adhesive technologies. A qualitative systematic review was conducted to identify patients' experiences with the application of medical adhesives to the skin.

DESIGN

61 Qualitative systematic review.

63 DATA SOURCES

64 CINAHL, EMBASE, MEDLINE and PsycINFO were systematically searched for records 65 published between January 2012 and March 2024. Reference lists of systematic reviews and 66 included articles were reviewed.

68 ELIGIBILITY CRITERIA

69 Studies published in Danish, Dutch, English, German, Norwegian and Swedish that collected 70 qualitative data on the experience of patients with the application of medical adhesives to the 71 skin were considered. There were no restrictions regarding age, gender or setting.

73 DATA EXTRACTION AND SYNTHESIS

Study selection, data extraction and quality appraisal was independently conducted by two
 reviewers. The methodological quality of the studies under consideration was assessed using
 the Joanna Briggs Institute Critical Appraisal Tool for Qualitative Research. The extracted data
 was synthesized using meta-aggregation.

RESULTS

Nine studies describing patients' experiences were included. The included studies only reflected experiences with wound dressings. Meta-aggregation of the extracted findings resulted in seven categories that were further synthesized into two synthesized findings: 'Strategies to alleviate pain during dressing changes' and 'Dressing construction and characteristics'. The synthesized findings illustrate that patients experience pain during dressing change and removal and employ various strategies to alleviate this pain.

87 CONCLUSIONS

Patients experience pain and discomfort when dressings are changed or removed. Future research should focus on enhancing both routines and technologies, with a particular emphasis on advancing skin-friendly adhesives to reduce unwanted side effects.

PROSPERO REGISTRATION NUMBER

93 CRD42023457711

BMJ Open

Patients' experiences with the application of medical adhesives to the skin

KEYWORDS

Adhesives; Discomfort; Meta-Aggregation; Pain; Patient Experiences; Skin; Systematic
 Review

98 Article summary

99 STRENGTHS AND LIMITATIONS OF THIS STUDY

- This systematic review summarizes qualitative evidence on the experiences of patients with the application, presence and removal of medical adhesives from the skin using meta-aggregation, a suitable method for qualitative data synthesis.
 - Only four databases MEDLINE, CINAHL, EMBASE and PsycINFO were systematically searched.
 - This systematic review considered studies published in Danish, Dutch, English, German, Norwegian and Swedish.
 - The study selection, data extraction and quality appraisal were performed in duplicate, which strengthens the reliability and minimizes potential bias.
Main text

INTRODUCTION

Medical adhesives are defined as adhesives used in medical devices to establish and maintain contact with the body over a period of time (usually by application to the skin). They are a component of a variety of products, including bandages and dressings for wound care, ostomy supplies and patches, adhesive film or tape to secure various catheters, tubes and electronic devices (e.g. adhesives used for securing ECG and EEG electrodes to the skin) (1, 2). Medical adhesives are frequently used in an array of healthcare settings in all patient groups. From premature babies, who often require medical adhesives to secure nasogastric and ventilation tubes, to patients with an ostomy who frequently have to reapply the adhesive stoma products to their skin. In an acute care facility in the United States, a median of 3.00 – 6.25 adhesive products were used on the skin per patient per day (3).

Patients may experience pain when changing the medical adhesive (4, 5). The patient's perception of pain is influenced by several factors such as mental and physical health conditions, previous negative experiences, types of medical adhesive used (6). Therefore it has been recommended to perform a pain assessment at every dressing change (7). Pain and discomfort can cause chronic stress, which might result in impaired wound healing (8, 9). Especially in children, pain can lead to emotional trauma and even posttraumatic stress (10, 11), which potentially results in avoidance of trauma reminders and negative moods or cognitions (12). Pain is defined as "An unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage" (13). Activation of nociceptors in the epidermis sends signals about potential or actual tissue damage which causes the experience of pain (14). This starts an autonomic stress response which includes heart rate elevation and metabolic changes. Stress exacerbates the pain experience (14).

Skin damage can cause pain and discomfort in patients (9, 15-17). Application and removal of medical adhesives to the skin can lead to skin stripping, contact dermatitis, or allergic reactions that may manifest as inflammation associated with itching or pain. Adhesive-related skin injury can lead to infection, delayed wound healing and an increased risk of scarring (2). Medical adhesive-related skin injury (MARSI) occurs when the adhesive material's adhesion to the skin is stronger than the adhesion between the skin's cells upon removal. This leads to the separation of epidermal layers or the complete detachment of the epidermis from the dermis, observed as erythema, cuts and blisters (7). Medical adhesive related skin injuries can occur in any patient, but elderly patients and newborns are particularly susceptible (18-20).

Despite the frequent use, medical adhesive related injuries are rarely reported (7). Previous studies have shown that nurses did not take action to prevent pain and skin tearing when carrying out dressing change (17). Understanding the patient's experience with medical adhesives is crucial to determine the focus of further research, to establish policies and to raise awareness among healthcare professionals with the aim of minimizing adverse effects and enhancing patient outcomes during the use of medical adhesives.

Therefore, this systematic review aimed to answer the following research question: "What are patients' experiences with the application of medical adhesives to the skin?"

Page 6 of 29

Enseignement Superieur (ABES) Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies.

Patients' experiences with the application of medical adhesives to the skin

This systematic review is reported according to the Enhancing Transparency in Reporting the

Synthesis of Qualitative Research statement (ENTREQ) criteria (21). Meta-aggregation was

used to synthesize the results based on the guideline from the Joanna Briggs Institute (JBI)

(22). This review is registered with the PROSPERO International Prospective Register of

Systematic Reviews (registration number: CRD42023457711). The protocol of this review has

A two-step strategy was used to identify relevant studies. First, a systematic search in four

electronic databases was conducted: CINAHL (accessed through the EBSCO interface),

EMBASE (accessed through Elsevier), MEDLINE (accessed through the Ovid interface) and

PsycINFO (accessed through the EBSCO interface). For the initial searches in MEDLINE the

concepts 'experience' (keywords include 'pain', 'dermatitis', 'itching', 'pruritus' and

'discomfort') and 'removal of dressings' (keywords include 'adhesive', 'bandage', 'dressing',

'adverse event', 'device deficiency', 'removal', 'change' and 'application') were used. The initial

search strategy was customized for each electronic database (see supplementary file 1).

Second, the reference lists of relevant systematic reviews and included articles in this review

were screened to identify additional studies that were not retrieved through the first strategy.

- 178 Eligibility criteria
 179
 - 180 Population and context

METHODS

This review focused on patients who currently or in the past had medical adhesives applied to their skin. There were no restrictions regarding sex or age.

184185 Phenomena of interest and study design

been published previously (23).

Search strategy and information sources

186
 187
 187
 188
 187
 188
 188
 188
 188
 188
 188
 188
 189
 189
 189
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180
 180

190191 Setting, language and time frame

There were no restrictions regarding settings. Articles published in Danish, Dutch, English, German, Norwegian and Swedish were considered. Due to continuous technological advances in the field of medical adhesives (24-26), this review tried to focus on medical adhesives that are currently still being used in clinical practice by restricting the search period. Therefore, the initial search was conducted to identify records with a publication date between January 2012 and November 2022. The search was repeated in March 2024 to identify any additional studies.

51 200 52 201

201 Study selection, data collection and management

All databases underwent individual searches, and the retrieved records were then exported into Covidence software for systematic reviews (Veritas Health Innovation, Melbourne, Australia). Following this, duplicates were identified and subsequently eliminated. The screening of records was conducted independently by two reviewers (HH, TD). In case of disagreement, discussions were held until consensus was reached. If there was no consensus, a third member of the review team was consulted (ME or DB). First, the titles and

Patients' experiences with the application of medical adhesives to the skin

³ 208 abstracts of the records were screened against the inclusion criteria. In a second round, the full text of the selected articles was screened.
 ⁵ 210

211 Assessment of methodological quality

The methodological guality of the studies under consideration was assessed independently by two reviewers (HH, TD). The Joanna Briggs Institute Critical Appraisal Tool for Qualitative Research was used (27). In cases of disagreement, discussions were held among the reviewers to reach consensus about the methodological quality. If necessary, a third reviewer was involved to resolve remaining disagreements (DB).

13 217 14 218 Data extraction

From the included studies, (a) bibliographic information (lead author, year, title, journal, full citation) (b) study design and sample size, (c) patient demographics, setting and geographical context, (d) description of how the research findings are addressed in the article, (e) method of data collection, (f) method of data analysis, (g) context (product names/brands or type of material of medical adhesives investigated), (h) phenomenon of interest (experience of patients with the application of medical adhesives to the skin) and (i) findings and illustrations were extracted. Definitions of findings and illustrations in meta-aggregation are provided in Table 1: Key Concepts and Terminology in Meta-Aggregation.

Data extraction was independently conducted by two reviewers (HH, TD), with any ambiguities addressed through discussion within the research team. Final data extraction was accomplished through reviewer discussions, ensuring consensus was reached. Another member of the research team (ME, DB) performed quality control of the extracted data on 20% of the included articles.

Key concept	Definition			
Finding	A verbatim extract of the author's analytical interpretation of the results or data (22)			
Illustration	A direct quotation of a participant's voice, fieldwork observation or other supporting data from the paper (22)			
Unequivocal finding	Findings accompanied by an illustration that is beyond reasonable doubt (22, 27)			
Equivocal finding	Findings accompanied by an illustration lacking clear association with the finding and therefore open to challenge (22, 27)			
Unsupported finding	Findings that are not supported by the data (22, 27)			
Category	A brief description of a key concept arising from the aggregation of two or more like findings (22, 27)			
Synthesized finding	An overarching description of a group of categorized findings (22, 27)			

233 Table 1: Key Concepts and Terminology in Meta-Aggregation.

55 234 Data synthesis

 Meta-aggregation was used to summarize the evidence. A level of plausibility was allocated to each extracted finding: unequivocal, equivocal and unsupported. Unsupported findings do not appear in the data synthesis (22, 27).

Patients' experiences with the application of medical adhesives to the skin

Meta-aggregation was completed according to the following steps: (a) each article was read repeatedly to extract all findings from the results and discussion section of the included studies, accompanied by an illustration; next, a level of plausibility was allocated to the extracted finding, (b) findings were summarized into categories based on similarity of concepts and (c) synthesized findings were derived from categories (22, 27). Category descriptions and synthesized findings were created by a consensus process between three members (HH, TD, DB) of the review team, after repeated reading of the extracted findings.

246 247 Patient and public involvement

No patients were involved in the design or conduct of this systematic review.

16 250 **RESULTS**

17251Screening and search outcome1825151

The literature search identified 5463 records. No additional records were identified through manual search. After removing duplicates, two reviewers (HH, TD) independently screened the title and abstract of 3102 articles using the software tool Covidence. The eligibility of 160 articles was assessed by screening the full texts. After full text screening 151 studies were excluded. In total, 9 studies were included. The search and selection process is summarized in Figure 1 (28).

25 258 26 259 Description of included studies

260 The included studies were published between 2013 and 2023. Five studies were conducted
261 in the United Kingdom (29-33), and one each in Turkey (34), Brazil (35), Ireland (36) and China
262 (37). Four studies adopted a phenomenological approach (30, 34, 35, 37). Seven studies used
263 semi-structured interviews, in-depth interviews or focus groups.

Various methods for data analysis were employed across these studies. Data collection was conducted either directly from patients or through proxies such as parents, healthcare providers, or informal caregivers. Sample sizes across the studies varied, ranging from 7 to 150 participants. All medical adhesives used in the included studies were wound dressings. Table 2 provides a detailed overview of the study characteristics.

Page 9 of 29

BMJ Open Patients' experiences with the application of medical adhesives to the skin

act evaluation qualitative onent	To gain insight into the patient experience, especially in regard to patient choice of	Clinicians asking patients one	No formal data	Patients who were	Wound	Patient	CutiMed Siltec
	product.	question and asking them to provide comments to it	(themes were formed from the comments)	care service with low to high-exuding wounds (n= 150)	serviceot arember trust trust relatec		B(order) - also CutiMed Siltec and CutiMed siltec Plus were used in this study
ecific study n is mentioned	To explore the feasibility of the use of analgesic dressings in older adults with leg ulcers, including their perception of current pain management, feasibility of an analgesic dressing, and potential challenges.	Focus group interviews (n= 2)	Framework analysis	Community nurses at the University of Greenwich, who attended a wound care class (n= 15)	Nursing within the Comparison of the Comparison	Proxy: Nurses	Not reported
I-methods rch; phase 1 ed interviews	To produce a comprehensive list of potential issues relating to wound and dressing experience and practical management issues.	Semi-structured interviews	Coding + method of constant comparison to derive themes from the data	Patients who had undergone, or were scheduled to undergo, an abdominal surgical procedure or caesarean section (n= 39)	Two university- teaching NHS hospitats and three district NHS hospitats in the Southwest and Midlands regions of England	Patient	Varied between adhesive coverings (absorptive or non- absorptive) and tissue adhesive as a dressing (brands were not reported)
-scale ative usability using a n-centered ach	To explore patient and staff perceptions of the impact and usability of active and passive virtual reality during painful dressing changes.	Semi-structured interviews (patients) and focus groups (staff)	Semantic analysis for developing themes + constant comparative analysis	Adult inpatients at the local Burns Unit – individual interviews (n= 5) and qualified nurses – focus group (n= 3)	One load Burns ar technolog	Patient and proxy: Nurses	Not reported
ative ipatory rch design	To identify unmet needs within the epidermolysis bullosa population in relation to wound dressings and to translate these needs into design concepts and novel products.	Workshop data enhanced by field notes collected during workshops, visits to participants in their homes or in hospital to observe dressing changes	Brainstorming workshop was to begin the creative and analytic process of formulating innovative design concepts. Findings from these sessions were fed	Patients with epidermolysis bullosa (A total of 4 workshops were held with numbers of participants ranging from 6 to 20)	Hospita epidermolysis bullosa clinics Agence Bibliog	Patient and proxy: Informal caregivers and clinical nurse specialists	Participants used a variety of products to hold the dressings in place such as bandages, tapes and elastic hosiery. (brands were not reported)
	methods ch; phase 1 ed interviews scale tive usability using a i-centered ich ative batory ch design	dressings in older adults with leg ulcers, including their perception of current pain management, feasibility of an analgesic dressing, and potential challenges.methods ch; phase 1 ed interviewsTo produce a comprehensive list of potential issues relating to wound and dressing experience and practical management issues.scale tive usability using a i-centered achTo explore patient and staff perceptions of the impact and usability of active and passive virtual reality during painful dressing changes.ative boatory ch designTo identify unmet needs within the epidermolysis bullosa population in relation to wound dressing concepts and novel products.	dressings in older adults with leg ulcers, including their perception of current pain management, feasibility of an analgesic dressing, and potential challenges.(n= 2)methods ch; phase 1 ed interviewsTo produce a comprehensive list of potential issues relating to wound and dressing experience and practical management issues.Semi-structured interviewsscale tive usability using a i-centered ichTo explore patient and staff perceptions of the impact and usability of active and passive virtual reality during painful dressing changes.Semi-structured interviewsative batory ch designTo identify unmet needs within the epidermolysis bullosa population in relation to wound dressings and to translate these needs into design concepts and novel products.Workshop data enhanced by field notes collected during workshops, visits to participants in their homes or in hospital to observe dressing changes	dressings in older adults with leg ulcers, including their perception of current pain management, feasibility of an analgesic dressing, and potential challenges.(n= 2)methods ch; phase 1 id interviewsTo produce a comprehensive list of potential issues relating to wound and dressing experience and practical management issues.Semi-structured interviewsCoding + method of constant comparison to derive themes from the datascale tive usability using a i-centered ichTo explore patient and staff perceptions of the impact and usability of active and passive virtual reality during painful dressing changes.Semi-structured interviewsSemantic analysis for developing themes + constant comparative analysisative batory ch designTo identify unmet needs within the epidermolysis bullosa population in relation to wound dressings and to translate these needs into design conceptsWorkshop data enhanced by field notes collected during workshops, visits to participants in their homes or in hospital to observe dressing changesBrainstorming workshop was to begin the creative and analytic process of formulating innovative design concepts. Findings from these sessions were fed	dressings in older adults with leg ulcers, including their perception of current pain management, feasibility of an analgesic dressing, and potential challenges.(n= 2)Greenwich, who attended a wound care class (n= 15)methods ch; phase 1 ch potential issues relating to wound and dressing experience and practical management issues.Semi-structured interviewsCoding + method of constant comparison to derive themes from the dataPatients who had undergone, or were scheduled to undergone, or were scheduled to undergone, an abdominal surgical matogement issues.scale tich virtual reality during painful dressing changes.To explore patient and staff perceptions of the interviews (staff)Semi-structured interviews (patients) and focus groups (staff)Semantic analysis for developing themes + constant comparative analysisAdult inpatients at the local Burns Unit - individual interviews (staff)ative atory ch designTo identify unmet needs within the epidermolysis holdes apopulation in relation to wound dressings and to translate these needs into design conceptsWorkshop data enhanced by field notes collected bulloss apopulation in nelation to wound dressing and novel products.Workshop was to boserve dressing form these form these sessions were fedPatients with epidermolysis 	dressings in older adults with leg ulcers, including their perception of current pain management, feasibility of an analgesic dressing, and potential challenges.(n= 2)Greenwich, who attended a wound care class (n= 15)University Greenwich, who attended a wound care class (n= 15)University Care class (n= 15)University Care class (n= 15)Unit Tourity care class (n= 15)Unit Two unity creative constant comparities at the class in the scale into design on care areas section (n= 30)Patients with epidemolysis builts on to log in the scale and yassis for developing the analysis for developing the analysis for developing the analysis enhanced by field notes collected during workshops, <b< td=""><td>dressings in older adults with leg ucers, including their perception of current pain management, feasibility of an analgesic dressing, and potential challenges. (n= 2) Greenwich, who attended a wound care class (n= 15) Universection attended a wound care class (n= 15) Universection attended a wound care class (n= 15) Universection attended a wound care class (n= 15) Patients who had undergone, or were scheduled to undergone, an abdominal surgical procedure or casarean section (n= 39) To wo universection attended a wound care class (n= 15) Two universection attended a wound care class (n= 15) Two universection attended a wound care class (n= 15) Two universection attended a wound care class (n= 15) Patient attended a wound compensative analgesic dressing experience and practical management issues. Semi-structured interviews (patients) and focus groups (staff) Coding + method of constant interviews (n= 39) Patient to undergone, or were scheduled to undergone, an abdominal surgical procedure or casarean section (n= 39) Two universection addominal surgical process of and qualified nurses - focus group (staff) Patient and proxy: Nurses Patient and proxy: Nurses title victual reality during paintip attended ators and novel products. Workshop data enhanced by field during workshops, visits to paticipants in their homes or in hospital to pobserve dressing changes Brainstorming workshop was to paticipants ranging from these sessions were fed Hospitato attended a wound care class Patient a</td></b<>	dressings in older adults with leg ucers, including their perception of current pain management, feasibility of an analgesic dressing, and potential challenges. (n= 2) Greenwich, who attended a wound care class (n= 15) Universection attended a wound care class (n= 15) Universection attended a wound care class (n= 15) Universection attended a wound care class (n= 15) Patients who had undergone, or were scheduled to undergone, an abdominal surgical procedure or casarean section (n= 39) To wo universection attended a wound care class (n= 15) Two universection attended a wound care class (n= 15) Two universection attended a wound care class (n= 15) Two universection attended a wound care class (n= 15) Patient attended a wound compensative analgesic dressing experience and practical management issues. Semi-structured interviews (patients) and focus groups (staff) Coding + method of constant interviews (n= 39) Patient to undergone, or were scheduled to undergone, an abdominal surgical procedure or casarean section (n= 39) Two universection addominal surgical process of and qualified nurses - focus group (staff) Patient and proxy: Nurses Patient and proxy: Nurses title victual reality during paintip attended ators and novel products. Workshop data enhanced by field during workshops, visits to paticipants in their homes or in hospital to pobserve dressing changes Brainstorming workshop was to paticipants ranging from these sessions were fed Hospitato attended a wound care class Patient a

BMJ Open Patients' experiences with the application of medical adhesives to the skin

						÷ 89		
				back to the user group through subsequent workshops.		773 on 1 No ncluding for		
Probst et al. (2023), Ireland	Qualitative, descriptive design	To describe individuals' experiences for chronic wound-associated pain	Semi-structured interviews (telephone interviews)	Thematic analysis following Braun and Clarke framework	Adults with chronic wounds who experience chronic wound-associated pain (n= 13)	CommunityEnseignem uses related	Patient	'Dressing' and 'VAC dressing' (brands were not reported)
Roma et al. (2021), Brazil	Qualitative, exploratory research	To understand the perception and attitude of parents of newborns admitted to a neonatal unit about their children's pain.	Semi-structured interviews	Thematic analysis	Parents of 15 premature newborn babies with a gestational age of 24 to 36 weeks and chronological age of 8 days to 5 months and 3 days (n= 20)	Neona (1) Service (1) of a unit experied hospital peried data mile mile mile mile data mile mile mile mile data mile mile mile mile mile mile mile mile	Proxy: Parents of newborn children	Tape (brands were not reported)
Unver et al. (2018), Turkey	Qualitative, descriptive design (phenomenology)	To describe patients' pain experience, pain- coping skills, and the effect of negative pressure wound therapy-related pain on daily life activities following abdominal surgery.	Semi-structured interviews	Colaizzi's method of phenomenological data analysis	Patients receiving Negative Pressure Wound Therapy in the abdominal area for the first time (n= 12)	Surgica of a univer, by hepital Al training, and	Patient	"Adhesive wrap" with foam dressing underneath (brands were not reported)
Wang et al. (2015), China	Qualitative, exploratory design (phenomenology)	To investigate medical workers' understanding of current pain management during dressing among children with burns and their attitudes toward the application of 50% nitrous oxide in pain management.	Semi-structured in-depth interviews	Content analysis and open coding	Doctors and nurses (n=7)	Burn conter of a tertiary aspectal in Eastern June 13, 2025 at A Giessen States	Proxy: Doctors and nurses	Not reported
Table 2: (Characteristics of	Included Studies.				Agence Bibliographiq		
- 3- 1 -		For peer r	eview only - http://	bmjopen.bmj.com	/site/about/guidelin	es.xhtml G		

Patients' experiences with the application of medical adhesives to the skin

³ 273 Assessment of methodological quality

The quality appraisal of the nine studies showed varying quality levels. All studies used suitable methodologies, but none addressed the researchers' cultural or theoretical background, and only one noted the potential influence of researchers on the outcomes (36). To ensure a comprehensive synthesis of the existing evidence, articles were not excluded based on low quality. Supplementary file 2 provides a detailed overview of the assessment of methodological quality.

11 280

12 281 Findings

Patients and health care providers reported that patients experienced pain during dressing removal and dressing changes (30, 32-34, 36, 37). From the 9 included studies, 43 findings were extracted after repeated reading of the text. 24 of the 43 extracted findings were supported by an illustration and were therefore allocated unequivocal or equivocal as level of plausibility. The supported findings were then aggregated into 7 categories, based on similarity in meaning (27). These categories were clustered further into 2 synthesized findings based on similarity of concepts: 'Strategies to alleviate pain during dressing changes' and 'Dressing construction and characteristics. Table 3 provides an overview of the meta-aggregation of the extracted supported findings.

The category 'Emotional response to pain caused by dressing changes' could not be clustered into any synthesized finding, since a synthesized finding has to consist of at least two categories (22, 27). Current or previous experiences of pain during dressing change can trigger an emotional response in patients. Health care providers described noncompliance with leg ulcer treatment in patients due to anxiety and anticipated pain based on previous painful experiences. "If you tell them we need to increase their visits they don't like it because obviously they know they're going to get pain ... it kind of puts them off and then they become non-compliant" (30). Patients reported that distraction by use of virtual reality gave them a sense of control over the situation, which resulted in a decrease in pain during dressing change. "Something as trivial as a video was actually quite empowering for me because I could take myself away" (32).

BMJ Open Patients' experiences with the application of medical adhesives to the skin

Finding	Cludin Category	Synthesized finding
Patients who were provided anesthesia before debridement and dressing changes reported they did not feel any pain. (UE) (34)	ng for u	
The majority of participants reported that pain is at its worst during dressing removal and changing. Patients therefore require pain relief that will last beyond the point of removal. (UE) (30)	ember Ensei	
One of the strategies was to take painkillers as prescribed by the physician, even though they sometimes caused some side effects such as stomachache or illusions. (UE) (36)	2024. I gnemei	
Many tissue viability nurses recommend that patients take additional analgesics prior to appointments for dressing changes. (UE) (30)	・ Anglesia is a strategy to 変絶感iate pain during 気気をいて、 ので、 ので、 ので、 ので、 ので、 ので、 ので、 ので	Stra
Some participants indicated providing recommendations to their care network about research or dressings on managing wound-associated pain. (E) (36)	haded fr	ategies t
Raising awareness about chronic wound-associated pain was another recommendation. Some participants highlighted the importance of immediately referring the wound patients to a pain manager if they mention having pain. (UE) (36)	om htt ABES)	o allevia
Medical workers agree that 50% nitrous oxide is applicable to dressing analgesia for children with burns. (UE) (37)	<mark>9, ∧1</mark>	ate p
A key factor in reducing pain and increasing tolerance of wound care seemed to be the degree of distraction created by VR. (UE) (32)	mjopen rainin	ain durir
Patients were unanimous that they had achieved good levels of distraction (and no nausea) in the active VR. Some spoke of awareness of pain and of what the nurses were doing. (UE) (32)	V Russian strategy to alleviate pain during dressing changes	ng dress
Without this distraction, normal behavior involved being drawn to and focusing on the wound and wound care, which increased pain. Not watching meant reduced pain. (UE) (32)	similar	sing cha
More than 10% of neonates hospitalized in the four units analyzed in the survey, in 2011, did not receive any analgesia in the first three postoperative days. Alisson's speech drew attention to other painful stimuli. (UE) (35)	une 13, :	anges
Participants thought there was a large gap between the current situation and their expectations. They expected to perform dressing with children's cooperation under noninvasive analgesia. They expected better measures to reduce the pain during dressing. (UE) (37)	Strategies to alleviate pain and suffering in children carsed by dressing	
For the pain suffered by children during dressing of burn wounds, all participants showed sincere sympathy: we provided a score of 0–10 to measure their degree of sympathy. All of them scored 10 (sincere sympathy). (UE) (37)	Bib	
	iogr	
Page 11	aphiqu	
For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtn	0 1 0	

Page 13 of 29	BMJ Open	njopen 1 by co		
1	Patients' experiences with the application of medical adhesives to	-20804-08 9y#Eght,	kin	
3	The main causes of dressing change pain were swift wrap removal and the resulting traumatized skin. (UE) (34)	9773 in iclu		
4 5 6	Nine participants specified having procedural pain and the pain level was influenced by their activities of daily living. (UE) (36)	ding Prot	cedures to remove	
7 8	Dressing removal: "I just completely soaked it [adhesive dressing] in the shower then my husband just took it off for me. But it was, it was really easy. Much easier than I thought.' (Patient, adhesive dressing)". (UE) (31)	vembe Ense		
9 10 11	Atraumatic application and removal, skin protection, good adherence with product remaining in place, comfort of product in place. (E) (29)	gneme	racteristics of an	Dres
12 13	It is essential that a dressing designed for leg ulcers only impacts on the wounds itself. (UE) (30)	ent Si	prinatic dressing	sing
14	Wound comfort (UE) (31)	nloa uperi r t an		cons
15 16	Reactions to the dressing (UE) (31)	d da	• erse reactions to the	struct
17 18 19	Participants noted that the amount of exudate and associated odour and leakage meant dressings required frequent changes, which were painful and time consuming, also evidenced in the way that pain was described was the 'pain' experienced by the carers. (UE) (33)	fr@m http (ABES) . ta mining	sing	ion and
20 21 22	One of the key problems reported with treating leg ulcers was noncompliance by the patients, often related to their anxiety around anticipated pain. (E) (30)	//bmjo Al tra		
22 23 24 25	Most spoke of positive emotions in response to the VR. The active VR in particular was "fun," "challenging," and "enjoyable" (various pts). Ns1 expressed surprise at participants' apparently pleasurable engagement with the technology. She spoke about "laughter," an outcome rarely associated with painful dressing changes. (UE) (32)	pen.bm#c ining, and	otional response to	
26 27 28 29 30 31	Two described feeling they could control part of the otherwise passive and traumatic dressing change experience when using VR. Having control meant retaining one's "humanity." The sense of having some control over the situation, along with the distraction and reduced pain, helped some patients manage their own emotional responses to the experience. There was a sense of pride in her achievement of self-control in circumstances which could otherwise be experienced as shameful, humiliating, and disempowering. (UE) (32)	parte on June 13, similar technol	rcaused by dressing nges	/
32	UE = unequivocal finding, E = equivocal finding, VR = Virtual Reality	gie:		
33 34 303 35 36 37 38 39 40	Table 3: Overview of Meta-Aggregation of the Extracted Findings.	5 at Agence Bibliogra _l s.		
41 42	Page 12	phiq	:	
43 44 45 46	For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtm	ue de l		

Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

Patients' experiences with the application of medical adhesives to the skin

304 Synthesized findings305

306 Strategies to alleviate pain during dressing changes

The synthesized finding *Strategies to alleviate pain during dressing changes* emerged from four categories: a) 'analgesia is a strategy to alleviate pain during dressing changes', b) 'Virtual Reality (VR) is a strategy to alleviate pain during dressing changes', c) 'strategies to alleviate pain and suffering in children caused by dressing changes and d) 'procedures to remove dressings' (Table 3).

a) Analgesia is a strategy to alleviate pain during dressing changes

Analgesia and anesthesia were described as strategies to alleviate pain during dressing changes (30, 34, 36, 37). Patients reported that being provided anesthesia before the dressing changes reduced the experienced pain. "On the first changing, they made me sleepy (with narcotics) and I didn't feel anything then the wraps were taken off the skin. They didn't anaesthetize me the second time, and it was much worse" (34). Health care providers similarly recommended patients to take additional analgesics prior to dressing change appointments in order to reduce pain during dressing (30, 36, 37), even though they sometimes triggered side effects (36). Some patients gave recommendations about research on dressings or pain management to their care network. "Olivia suggested focusing research on pain relieving dressings rather than drugs". Some also indicated the importance of timely referral to a pain manager (36).

b) Virtual Reality (VR) is a strategy to alleviate pain during dressing changes

Additionally, utilizing virtual reality (VR) was described as a strategy to alleviate pain during dressing changes. The use of VR distracted patients from focusing on the wound care and accompanying pain during dressing change. *"Before you were thinking, it hurts, because watching them do it makes it worse"* (32).

c) Strategies to alleviate pain and suffering in children caused by dressing changes

Parents and health care providers reported pain and suffering in neonates and children during dressing change (35, 37). "The day I most saw her crying in pain was when she removed the tape" (35). Even though pain during dressing change is a known problem, health care providers reported a gap between the current situation and their expectations regarding strategies to alleviate pain during dressing change in children. Patients received too little or even no pain relief (35, 37). "Analgesics available for children are quite few, children with burns cry all the time during the dressing, and we need available drugs or methods to relieve their pain" (37).

347 d) Procedures to remove dressings

Specific procedures for removal of dressings were described (31, 34). Unver et al. (2018) reported that swift removal of adhesives and the resulting skin trauma were the main causes of pain during dressing changes. Patients soaked the adhesive dressings in the shower to aid dressing removal and reduce removal pain. "I just completely soaked it [adhesive dressing] in the shower then my husband just took it off for me. But it was, it was really easy. Much easier than I thought" (31). Patients experienced procedural pain and indicated that activities of the daily living influenced pain levels. "Maybe sometimes with dressing changes, the worst pain I had was with the VAC dressing (Negative Pressure Wound Therapy)" (36).

Patients' experiences with the application of medical adhesives to the skin

358 Dressing construction and characteristics

The two categories a) 'characteristics of an atraumatic dressing' and b) 'adverse reactions to the dressing' have been synthesized on the basis that they both describe the constitution of the dressings used in the studies. This synthesized finding demonstrates that dressings should be designed in a way that facilitates easy removal and minimizes discomfort during wear.

a) Characteristics of an atraumatic dressing

Atraumatic application and removal were described as a characteristic of an atraumatic dressing. "Those dressings helped my mum's legs in that they didn't hurt here when the nurse took them off" (29). Additionally, skin protection of the peri-wound skin, good adherence, and comfort during wear of the adhesive dressing were highlighted as features of atraumatic dressings. "Very important not to have them stuck on the area that has just been healed, and it is very difficult to take it off without hurting the wound again, and I think that is terribly important" (29, 30).

b) Adverse reactions to the dressing

To minimize discomfort during dressing wear, potential adverse reactions to dressings must be considered when choosing an adhesive dressing. Frequent dressing changes due to leakages caused by highly exudating wounds, were reported as very painful. "*It is excruciating when the dressings keep coming on and off and she is in unbearable pain (reported by carer)*" (33). Itching and allergic reactions to the adhesives used were also described as uncomfortable adverse reactions to an adhesive dressing. "*I've now got really itchy where the plaster goes. Which is uncomfortable*" (31).

DISCUSSION

This systematic review aimed to synthesize patients' experiences with the application of medical adhesives to the skin. This systematic literature search only retrieved studies that included findings on wound dressings. No records reporting patients' experiences with other types of medical adhesives such as electrocardiography (ECG) electrodes, intravenous (IV) catheter patches, securement for medical devices, ostomy supplies et cetera were identified. All included studies in this review reported experiences with the changing and removal of dressings. No findings described patient experiences with the application and wear of adhesive dressing.

The results imply that patients experience pain and discomfort during dressing change and removal (30, 32-34, 37). Awareness among health care providers is important since a single painful experience can change nociceptive pathways and induce sensitization. This is a process that involves a reduction in the threshold of activation and an increased response rate to damaging stimulation (38, 39). Pain is a personal experience, influenced by biological, psychological and social factors to varying degrees (13). A clinical tool predicting severe pain (Numeric Rating Scale \geq 8) during wound dressing changes using clinically available wound and patient factors, was developed (40, 41). Expected pain intensity (p < 0,001; OR = 1,50), resting pain intensity (p < 0.001; OR = 1.19) and type of dressing (p < 0.05; OR 1.19 to 3.62) are significant predictors for experiencing high intensity pain during wound care procedures (overfitting-corrected AUC = 0,826). Sex, age, ethnicity chronic pain, opioid

Page | 14

Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

Patients' experiences with the application of medical adhesives to the skin

tolerance, anxiety, depression and pain catastrophizing were not significant predictors (41). Pain catastrophizing is measured by using "The pain catastrophizing scale" and the term is frequently used since the factors included in the measurements are a comprehensive predictor of pain. However, this term is controversial since people with chronic pain have reacted negatively towards it as the term diminishes the importance of the medical reason behind their pain and focuses too much on psychological factors, which in the end can lead to insufficient care (42). Through the use of neurological imaging, cortical and subcortical pathways have been identified that are activated when the patient expects pain. This is called anticipatory pain (43). Patients experiencing anxiety in relation to anticipatory pain can develop a reduced pain tolerance and lead to an increased self-reported pain intensity, resulting in more painful future procedures (40, 43, 44).

Along with describing experiences, patients and proxies describe the need for strategies to alleviate the pain and discomfort experienced during the application of dressings to the skin (30-32, 34, 35, 37). Both pharmacological and non-pharmacological interventions to alleviate dressing-related pain were described. Health care professionals describe the lack of an appropriate analgesic regimen for neonates needing their burn wounds dressed (37). Many infants get too little or no pain relieving interventions despite the existence of validated pain assessment tools and recommended actions for pain management when conducting medical procedures. The recommendation for neonates is both pharmacological measures, such as acetaminophen, opioids and local topical agents, and non-pharmacological measures, such as breastfeeding, skin-to-skin contact and sucrose solution together with non-nutritive sucking (45). In addition, distraction by virtual reality was described as a non-pharmacological intervention to reduce dressing change-related pain (32). Immersive virtual reality has been demonstrated to alleviate pain across various medical procedures, including dressing changes in patients with hand injuries (46). For patients to take prescribed analgesics before dressing changes and for nurses to recommend patients to take analgesics before dressing changes was also part of the synthesised finding (30, 36). Recommended pharmacological strategies for treating pain or breakout pain when changing dressings include increasing the dose of the analgesic already prescribed, adding another faster-acting pain medication or reducing the time in between doses (47).

Health professionals should improve their communication with patients about the risks related to adhesive wound dressing use. They should try to minimize pain during dressing removal and the occurrence of medical adhesive-related skin injuries (7). It is important for health professionals to understand the unique characteristics of an adhesive wound dressing for informed decision-making regarding the selection of the dressing (48). Dressing characteristics for atraumatic dressing removal were described in a few studies (29-33). Patients with atraumatic dressings using a silicone contact layer applied to their skin report significantly lower pain scores (p < 0.01) when compared to traditional adhesives (i.e. adhesive foams, hydrocolloids and other dressings) (49). It is also important for health professionals to have knowledge about the skin as well as knowledge about application and removal techniques for adhesive wound dressings and medical adhesives in general to prevent unnecessary damage to the patient (48). The barrier function of the skin can be damaged as a result of single or repeated application of adhesives, despite a reduction in adhesive strength during prolonged dressing wear (50).

Patients' experiences with the application of medical adhesives to the skin

Methodological considerations

This review used meta-aggregation to synthesize the findings. No member of the research team had previous experience with this data synthesis method. Therefore, meta-aggregation was performed independently by two members of the research team (HH, TD). Extracted findings were synthesized to a higher level of abstraction until consensus was reached. When necessary, a third member of the research team (DB) was consulted.

The methodological quality of the included studies was assessed, but no studies were excluded for low quality. However, all studies lacked reflexivity regarding researchers' cultural and theoretical backgrounds, with only one study addressing the potential influence of the researchers on the outcomes. Methodological guidelines for qualitative research recommend that researchers reflect on their own position, biases, and assumptions in their writings before and during the research process to minimize bias (51). The lack of a statement on reflexivity in the primary studies may indicate bias, as readers of these articles are not informed about the authors' perspectives and prejudices regarding the concept of pain before they started the analysis process.

472 Strengths and limitations

The systematic review only included studies containing qualitative data to explore patients' experiences with the application of medical adhesives to the skin, which resulted in only nine eligible studies. Employing quantitative studies in addition to gualitative articles might have provided interesting insights on pain and discomfort scores of patients while adhesive dressings are being removed. However, conducting a mixed-method review has several limitations, including difficulties of comparing results from these different paradigms is difficult and extends the time to complete the review (52).

Enseignement Superieur (ABES) Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies.

For this review, only four databases were systematically searched. MEDLINE, CINAHL and EMBASE are among the largest and most relevant databases in the field of nursing science. PsycINFO primarily covers psychology, behavioral science and mental health. These databases were selected to ensure comprehensive coverage of primary studies containing qualitative data on patients' experiences with the application of medical adhesives to the skin. Their scope makes them the optimal choice for capturing the most relevant studies for the data synthesis.

Only studies published between January 2012 and March 2024 were considered. The initial search for this systematic review was conducted in November 2022, focusing on articles published between January 2012 and November 2022. The search was updated in March 2024 to capture any new publications on the topic of this review. In light of the ongoing advancements in medical adhesives and technological innovations (24-26), this study aimed to focus on adhesives currently used in clinical practice. Additionally, during the last ten years, pain research has advanced significantly (13). Limiting the timeframe from January 2012 to March 2024 enabled incorporation of the latest knowledge and developments in the field.

497 The study characteristics of the included studies, such as age, setting and country,
 498 were heterogeneous. Since only a limited amount of findings could be extracted, it was
 499 not possible to identify potential cultural differences in the reported findings.

Patients' experiences with the application of medical adhesives to the skin

Studies that were published in languages other than Danish, Dutch, English, German,
 Norwegian or Swedish were not screened through the search strategy. This may have
 led to the exclusion of relevant articles published in another language.

Four of the included studies (30, 32, 34, 37) did not specify the used dressing type or
 brand. No additional information on dressing type or brand was retrieved by contacting
 the authors. As a result, not all of the published information could be synthesized fully.

This systematic review describes patients' experiences with the application of dressings on various wound types: burn wounds (32, 37), chronic leg ulcers (30), surgical wounds (31, 34) and epidermolysis bullosa (33). Pain can also be caused by tissue damage (53). Reported experiences of pain and discomfort with the application of medical adhesives to the skin might consequently be obscured by wound pain (36, 511 41).

512 This study did not involve patients or the public in its conceptualization, design or 513 conduct. This qualitative systematic review is part of a larger research project, the 514 TAPE-research project, which consists of four phases. In the subsequent phases of 515 this project, patients will be involved in refining the research objectives to ensure the 516 concerns of patients who use medical adhesives are addressed.

517 Implications for research and clinical practice

Future research should focus on exploring routines to reduce unwanted side effects with medical adhesive use in clinical practice. This will guide improvement of adhesive technologies, the establishment of policies, and raise awareness among healthcare professionals regarding the pain and discomfort related to medical adhesives application to the skin.

Pain and discomfort related to the application, presence and removal of medical adhesives are often overlooked. A lack of established policies and training exacerbates the issue. Pharmacological interventions designed to alleviate pain and discomfort related to the application, use and removal of medical adhesives often result in unwanted side effects. Nonpharmacological interventions offer alternatives but costs of necessary equipment, such as virtual reality materials, may result in a limited availability. Establishing policies and raising awareness among healthcare professionals is needed (5, 17). This can be done through an educational effort as well as raising awareness on a higher level in the healthcare system, for example questioning the materials being bought for hospital wide use. When cost is the deciding factor, it is important to evaluate whether different brands offer comparable adhesion and skin protection.

Future research should focus on enhancing both routines and technologies, with a particular emphasis on advancing skin-friendly adhesives to reduce unwanted side effects. Interviewing patients about their experiences and doing a narrative description of specific aspects of the dressing change process could be of value. Since medical adhesives are frequently used in all patient groups and the findings of this study indicate that patients experience pain when dressings are being removed, future qualitative research should explore patient experiences with other types of medical adhesives (ECG electrodes, IV patches, et cetera).

57
58
59544Future dressing development should focus on material science, cell biology an
intelligent technology to develop multi-purpose dressings that can further improve
wound management (54). In some cases, there will be a need for medical adhesives

Page | 17

Patients' experiences with the application of medical adhesives to the skin

that adhere more strongly to the skin to prevent dislocation of life-saving medical
devices such endotracheal tubes and intravenous catheters in an intensive care
setting.

550 CONCLUSION

The meta-aggregation performed in this study implies that patients do experience pain and discomfort when wound dressings are changed or removed. The synthesized findings of this review 'strategies to alleviate pain during dressing changes' and 'dressing construction and characteristics' can serve as a guide to improve clinical ic. ind prevent routines for adhesive dressing use, avoid pain and discomfort while changing adhesive dressings (4, 5) and prevent emotional trauma and post-traumatic stress in children (10, 11).

Patients' experiences with the application of medical adhesives to the skin

Footnotes

560 AUTHOR CONTRIBUTIONS

HH and TD contributed equally to this paper. All authors contributed to the conception of the research question and the writing of the protocol. HH, DB, SJ, JK, LMK, and ME contributed to the development of search strategies, eligibility criteria, and methodology for data synthesis. All authors contributed to the draft protocol and approved the final version of the protocol. HH, TD, and ME worked in duplicate to review the titles and abstracts of all materials obtained using the search strategy to exclude articles that do not meet the eligibility criteria. HH and TD evaluated potentially eligible studies through full-text screening and excluded non-eligible studies, documenting the reason for exclusion. HH and TD independently extracted data from the included studies. ME and DB checked the quality on 20% of the extracted data of the included articles. HH and TD synthesized the data and drafted the manuscript. All authors read, provided feedback, and approved the final manuscript. ME is responsible for the overall content as guarantor.

574 COMPETING INTERESTS

575 None declared.

576 FUNDING

577 This systematic review is supported by Mölnlycke Health Care AB, grant number 578 68003673. Mölnlycke Health Care AB was not involved in any other aspect than the 579 funding of this systematic review. The funder had no input on the interpretation or 580 publication of the study results.

582 DATA SHARING STATEMENT

All data relevant to the study are included in the article or uploaded as supplementary
 information.

586 ETHICS APPROVAL

587 This systematic literature review uses published literature and did not recruit 588 participants. Therefore, no formal ethical approval or consent was necessary. This 589 systematic review protocol is published in an open access journal to increase 590 transparency of the research methods used.

592 ACKNOWLEDGEMENTS

Mölnlycke Health Care AB provided financial support to conduct this systematic review.
We would also like to thank Samal Al Gilani, RN, PhD, for participating in the planning
of the project and in some additional screening.

Patients' experiences with the application of medical adhesives to the skin

8	References
9	
)	1. Medical device adhesives, sealants and coatings for the medical device
	industry 2024 [Available from: https://www.medicaldevice-network.com/buyers-
	guide/medical-adhesives/.
	2. McNichol L, Lund C, Rosen T, Gray M. Medical adhesives and patient safety:
	state of the science: consensus statements for the assessment, prevention, and
	treatment of adhesive-related skin injuries. Orthop Nurs. 2013;32(5):267-81.
	3. Farris MK, Petty M, Hamilton J, Walters SA, Flynn MA. Medical Adhesive-
	Related Skin Injury Prevalence Among Adult Acute Care Patients: A Single-Center
	Observational Study. J Wound Ostomy Continence Nurs. 2015;42(6):589-98.
	4. Kammerlander G, Eberlein T. Nurses' views about pain and trauma at
	dressing changes: a central European perspective. J Wound Care. 2002;11(2):76-9.
	5. Hollinworth H, Collier M. Nurses' views about pain and trauma at dressing
	changes: results of a national survey. J Wound Care. 2000;9(8):369-73.
	6. Woo KY. Unravelling nocebo effect: the mediating effect of anxiety between
	anticipation and pain at wound dressing change. Journal of clinical nursing.
	2015;24(13-14):1975-84.
	7. Fumarola S, Allaway R, Callaghan R, Collier M, Downie F, Geraghty J, et al.
	Overlooked and underestimated: medical adhesive-related skin injuries. Journal of
	wound care. 2020;29(Sup3c):S1-S24.
	8. Matsuzaki K, Upton D. Wound treatment and pain management: a stressful
	time. Int Wound J. 2013;10(6):638-44.
	9. Reevell G, Anders T, Morgan T. Improving patients' experience of dressing
	removal in practice. Journal of Community Nursing. 2016;30(5).
	10. Hildenbrand AK, Marsac ML, Daly BP, Chute D, Kassam-Adams N. Acute
	Pain and Posttraumatic Stress After Pediatric Injury. J Pediatr Psychol.
	2016;41(1):98-107.
	11. Holley AL, Wilson AC, Noel M, Palermo TM. Post-traumatic stress symptoms
	in children and adolescents with chronic pain: A topical review of the literature and a
	proposed framework for future research. Eur J Pain. 2016;20(9):1371-83.
	12. American Psychiatric Association. Diagnostic and Statistical Manual of Mental
	Disorders 5ed. Arlington, USA: American Psychiatric Publishing; 2013.
	13. Raja SN, Carr DB, Cohen M, Finnerup NB, Flor H, Gibson S, et al. The
	revised international Association for the Study of Pain definition of pain: concepts,
	challenges, and compromises. Pain. 2020;161(9):1976-82.
	14. vverner M, Leden I. Smarta och smärtbehandling: Liber; 2010.
	15. Bianchi J. Protecting the integrity of the periwound skin. Wound Essentials.
	2012;1:58-64.
	16. Collier M. Minimising pain and medical adhesive related skin injuries in
	vulnerable patients. British Journal of Nursing. 2019;28(15):S26-S32.
	17. Kim JY, Kim NK, Lee YJ. A descriptive study of Korean nurses' perception of
	pain and skin tearing at dressing change. Int Wound J. 2016;13 Suppl 1(Suppl 1):47-
	51. 40. August DL Navy K. Dav DA K. J. V. F. J.
	18. August DL, New K, Ray RA, Kandasamy Y. Frequency, location and risk
	ractors of neonatal skin injuries from mechanical forces of pressure, friction, shear
	and stripping: a systematic literature review. Journal of Neonatal Nursing.
	2018;24(4):173-80.
	19. Cutting K. Impact of adhesive surgical tape and wound dressings on the skin,
	with reference to skin stripping. Journal of Wound Care. 2008;17(4):157-62.
	20. Jones L, Bell D, Hodgson C, Mohamud L, Stephan-Haynes J, Callaghan R, et
	al. Case study series: Litteez aerosol and wipes for the prevention and management
	of MARSI. Wounds UK. 2018;14(5).

Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

BMJ Open

Patients' experiences with the application of medical adhesives to the skin

2		
3	651	21. Tong A. Flemming K. McInnes E. Oliver S. Craig J. Enhancing transparency
4	652	in reporting the synthesis of qualitative research: ENTREQ, BMC Med Res Methodol.
5	653	2012.12.181
6	654	22 Lockwood C. Porritt K. Munn Z. Rittenmever L. Salmond S. Bierrum M. et al.
7	655	Chapter 3: systematic reviews of qualitative evidence. Aromataris F L C. Porritt K
8	656	Pilla B. Jordan Z. editor: Joanna Briggs Institute: 2024
9	657	23 Hofman H. Beeckman D. Duliic T. Al Gilani S. Johansson S. Kottner I. et al
10	659	Datients' experiences with the application of medical adhesives to the skin: a
11	650	qualitative systematic review protocol BMI Open 2023:13(6):e073546
12	660	24 Karp IM Langer P. Dry solution to a sticky problem. Nature
13	000	
14	661	2011,477(7502).42-5.
15	662	25. Zuikowski K. Understanding moisture-associated skin damage, medical
16	663	adnesive-related skin injuries, and skin tears. Advances in skin & wound care.
17	664	2017;30(8):372-81.
18	665	26. Hwang I, Kim HN, Seong M, Lee SH, Kang M, Yi H, et al. Multifunctional
19	666	smart skin adhesive patches for advanced health care. Advanced healthcare
20	667	materials. 2018;7(15):1800275.
21	668	27. Lockwood C, Munn Z, Porritt K. Qualitative research synthesis:
22	669	methodological guidance for systematic reviewers utilizing meta-aggregation. JBI
23	670	Evidence Implementation. 2015;13(3):179-87.
24	671	28. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et
25	672	al. The PRISMA 2020 statement: an updated guideline for reporting systematic
20	673	reviews. Bmj. 2021;372:n71.
27	674	29. Bateman SD. 150 patient experiences with a soft silicone foam dressing. Br J
20	675	Nurs. 2015;24(12):S16, s8-23.
30	676	30. Docking R, Boateng J, Catanzano O, Schofield P. A Preliminary Study of Pain
30	677	Relieving Dressings for Older Adults With Chronic Leg Ulcers From the Provider's
37	678	Perspective: A Qualitative Study. J Pain Palliat Care Pharmacother. 2018;32(2-3):71-
33	679	81.
34	680	31. Elliott D, The Bluebelle Study Group. Developing outcome measures
35	681	assessing wound management and patient experience: a mixed methods study. BMJ
36	682	Open. 2017:7(11):e016155.
37	683	32. Furness PJ. Phelan I. Babiker NT. Fehilv O. Lindlev SA. Thompson AR.
38	684	Reducing Pain During Wound Dressings in Burn Care Using Virtual Reality: A Study
39	685	of Perceived Impact and Usability With Patients and Nurses, J Burn Care Res.
40	686	2019:40(6):878-85
41	687	33 Grocott P Blackwell R Weir H Pillay F Living in dressings and bandages
42	688	findings from workshops with people with Endermolysis bullosa. Int Wound J
43	689	2013·10(3)·274-84
44	690	34 Unver S. Evi S. Ozkan ZK. A Descriptive. Qualitative Study to Explore the
45	691	Pain Experience During Negative Pressure Wound Therapy for Postsurgical
46	602	Abdominal Wounds, Ostomy Wound Manage, 2018;64(12):38-48
47	603	35 Roma TM Carvalho Lam 7 Garcia Marques AC Llohoa Lones Pereira M
48	604	Motta E. Lamy Eilbo E. Dercontion and attitude of parents towards powhern pain in
49	094 605	noonatal unit. Povista de Posquisa: Cuidade o Eupdamental 2021:12(1)
50	606	Bendial unit. Nevisia de resquisa. Guidado e rundaniental. 2021, 13(1). 36 — Drobet S. Geobwind C. Murphy I. Sezain D. Carr P. Melatoch C. et al.
51	090	Detionte lacoontenee' of obronic wound apposited pain. A qualitative descriptive
52	600	ralients acceptance of chronic wound-associated pain - A qualitative descriptive study 1 Tissue Viability 2023;32/4):455.0
53	098	Sluuy. J HISSUE VIDUIIILY. 2020,02(4).400-8.
54	099	57. vvalig IIA, LI TA, Zhou RZ, Zhao JJ. Wedical workers' cognition of using 50%
55	/00	nitrous oxide in children with burns: a qualitative study. Burns. 2015;41(6):12/5-80.
56	701	Jo. DI Maio G, Villano I, Ilarol CK, Messina A, Monda V, Iodice AC, et al.
5/	/02	Int J
50 50	/03	Environ Res Public Health. 2023;20(4).
2A 2A		
00		

BMJ Open

Patients' experiences with the application of medical adhesives to the skin

2		
3	704	39 Li W. Gong Y. Liu J. Guo Y. Tang H. Qin S. et al. Peripheral and Central
4	705	Pathological Mechanisms of Chronic Low Back Pain: A Narrative Review J Pain
5	706	Res 2021.14.1483-94
6	707	40 Gardner SE Abbott I L Fiala CA Rakel BA Factors associated with high nain
7	708	intensity during wound care procedures: A model Wound Repair Regen
8	700	
9	709	A1 Gardner SE Bae I Ahmed BH Abbott I I Wolf IS Hein M et al A clinical
10	710	tool to prodict solvero pain during wound drossing changes. Dain 2022:163(0):1716
11	712	tool to predict severe pain during wound dressing changes. Fain. 2022, 105(9). 17 10-
12	/12	27. 42. Sullivan M.II. Trinn DA. Dain Catastranhizing: Controversion Missonantions
13	/15	42. Sullival MJL, The DA. Fail Galasi ophizing. Controversies, Misconceptions
14	/14	and Future Directions. J Pain. 2024,25(3).575-87.
15	715	43. WOO KY. Meeting the challenges of wound-associated pain: anticipatory pain,
16	716	anxiety, stress, and wound nealing. Ostomy wound Manage. 2008;54(9):10-2.
17	717	44. Feeney SL. The relationship between pain and negative affect in older adults:
18	718	anxiety as a predictor of pain. J Anxiety Disord. 2004;18(6):733-44.
19	719	45. Campbell-Yeo M, Eriksson M, Benoit B. Assessment and Management of
20	720	Pain in Preterm Infants: A Practice Update. Children (Basel). 2022;9(2).
21	721	46. Teh JJ, Pascoe DJ, Hafeji S, Parchure R, Koczoski A, Rimmer MP, et al.
22	722	Efficacy of virtual reality for pain relief in medical procedures: a systematic review
23	723	and meta-analysis. BMC Med. 2024;22(1):64.
24 25	724	47. Bechert K, Abraham SE. Pain management and wound care. J Am Col Certif
25	725	Wound Spec. 2009;1(2):65-71.
20	726	48. Downie F, Allaway R. Preventing Medical Adhesive Related Skin Injury
27	727	(MARSI): introducing a skincare regimen for good practice. Wounds. 2024;20(1):38.
20	728	49. White R. A multinational survey of the assessment of pain when removing
29	729	dressings. Wounds uK. 2008;4(1):14.
30	730	50. Mbithi F, Worsley PR. Adhesives for medical application - Peel strength
32	731	testing and evaluation of biophysical skin response. J Mech Behav Biomed Mater.
33	732	2023;148:106168.
34	733	51. Holloway I, Galvin K. Qualitative research in nursing and healthcare: John
35	734	Wiley & Sons; 2017.
36	735	52. Whitley GA. Munro S. Hemingway P. Law GR. Siriwardena AN. Cooke D. et
37	736	al. Mixed methods in pre-hospital research: understanding complex clinical problems.
38	737	Br Paramed J. 2020;5(3):44-51.
39	738	53. Shubayev VI, Kato K, Myers RR, Frontiers in Neuroscience
40	739	Cytokines in Pain. In: Kruger L. Light AR. editors. Translational Pain Research: From
41	740	Mouse to Man. Boca Raton (FL): CRC Press/Taylor & Francis
42	741	Copyright © 2010 by Taylor and Francis Group 11 C · 2010
43	742	54 Sul Jia Y Ful Guo K Xie S The emerging progress on wound dressings
44	742	and their application in clinic wound management. Helivon, 2023;9(12);e22520
45	743	and their application in clinic would management. Henyon, 2020,0(12).022020.
46		
47		
48		
49		
50		
51		
52		
53		
54		
55		

59 60

Page | 22

Enseignement Superieur (ABES) Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies

Patients' experiences with the application of medical adhesives to the skin

Figure legend

Figure 1: PRISMA flowchart

to per terien on



Figure 1: PRISMA flowchart

222x158mm (300 x 300 DPI)

BMJ Open: first published as 10.1136/bmjopen-2024-089773 on 1 November 2024. Downloaded from http://bmjopen.bmj.com/ on June 13, 2025 at Agence Bibliographique de I Enseignement Superieur (ABES) . Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies.

Ovid MEDLINE(R) and Epub Ahead of Print, In-Process, In-Data-Review & Other Non-Indexed Citations, Daily and Versions 1946 to March 13, 2024

Updated search date 2024-03-13 (initial search was made in March 2022-11-10)

Sea	rchterms		Results
Pai	n		
	1	Pain/ or Acute Pain/ or Pain, Procedural/ or Pain Measurement/ or	
		Pain Management/ or Pain Threshold/	
	2	(pain* or ache* or aching or distress* or suffer* or itch* or	
		discomfort* or anxious or anguished or agony or agonising or anxiety).ab,kf,ti.	
	3	1 or 2	
Rer	noval of c	Iressings	•
	4	Bandages/ or Bandages, Hydrocolloid/ or Occlusive Dressings/ or Adhesives/	
	5	Device Removal/	
	6	(remov* or redress* or chang* or select* or application* or cho?s*	
		or apply* or "device deficienc*" or "adverse event*").ab,kf,ti.	
	7	5 or 6	
	8	4 and 7	
	9	((fastener* or adhesive* or tape* or taping or bandaid* or bandag* or dressing* or mucilage* or "sticky past*" or gum or latex or adherent* or adhering or seal*) adj4 (remov* or redress* or chang* or select* or application* or cho?s* or apply* or "device deficienc*" or "adverse event*")).ab,kf,ti.	
Cor	nbined Se	ets	
	10	8 or 9	
	11	3 and 10	3,586
	12	limit 11 to (yr="2012-01-01 -2024-03-13" and (danish or dutch or english or norwegian or swedish))	1,988

EMBASE	E via Elsevier		
Updated	d search date 2024-03-13 (initial sea	rch was made in March	2022-11-10)

earchtern	ns	Results
Pain		
1	'pain'/de OR 'pain measurement'/exp OR 'procedural pain'/de OR 'analgesia'/de	
2	pain*:ti,ab,kw OR ache*:ti,ab,kw OR aching:ti,ab,kw OR distress*:ti,ab,kw OR suffer*:ti,ab,kw OR itch*:ti,ab,kw OR discomfort*:ti,ab,kw OR anxious:ti,ab,kw OR anguished:ti,ab,kw OR agony:ti,ab,kw OR agonising:ti,ab,kw OR anxiety:ti,ab,kw	
3	#1 or # 2	
Removal o	f dressings	
4	'bandages and dressings'/de OR 'adhesive tape'/exp OR 'adhesive bandage'/de OR 'crepe bandage'/de OR 'elastic adhesive bandage'/de OR 'tubular bandage'/de OR 'central line dressing'/de OR 'surgical tape'/de OR 'hydrocolloid dressing'/de OR 'occlusive dressing'/de OR 'adhesive agent'/de OR 'sealant'/de	
5	'device removal'/de	
6	remov*:ti,ab,kw OR redress*:ti,ab,kw OR chang*:ti,ab,kw OR select*:ti,ab,kw OR application*:ti,ab,kw OR cho\$s*:ti,ab,kw OR apply*:ti,ab,kw OR 'device deficienc*':ti,ab,kw OR 'adverse event*':ti,ab,kw	
7	#5 or #6	
8	#4 and #7	
9	(fastener* OR adhesive* OR tape* OR taping OR bandaid* OR bandag* OR dressing* OR mucilage* OR 'sticky past*' OR gum OR latex OR adherent* OR adhering OR seal*) NEAR/4 (remov* OR redress* OR chang* OR select* OR application* OR cho\$s* OR apply* OR 'device deficienc*' OR 'adverse event*')	
10	#8 or #9	
Combined	Sets	•
11	#3 and #10	5,298
12	#11 NOT 'conference abstract'/it AND ([danish]/lim OR [dutch]/lim OR [english]/lim OR [norwegian]/lim OR [swedish]/lim) AND [2012-01-01-2024-03-13]/py	2,160

PsycINFO via EBSCO

Updated search date 2024-03-13 (initial search was made in March 2022-11-10)

Searc	chterms		Results
Pain			
	S1	DE "Pain" OR DE "Acute Pain" OR DE "Pain Management" OR DE "Pain	
		Measurement" OR DE "Suffering"	
	S2	TI (pain* or ache* or aching or distress* or suffer* or itch* or	
		discomfort* or anxious or anguished or agony or agonising or anxiety)	
		OR AB (pain* or ache* or aching or distress* or suffer* or itch* or	
		discomfort* or anxious or anguished or agony or agonising or anxiety)	
	S3	S1 OR S2	
Remo	oval of d	ressings	
	54	TI ((fastener* or adhesive* or tape* or taping or bandaid* or bandage* or bandaging or dressing* or mucilage* or "sticky past*" or gum or latex or adherent* or adhering or seal*) N3 (remov* or redress* or chang* or selection* or application* or cho#s* or apply* or "device deficienc*" or "adverse event*")) OR AB ((fastener* or adhesive* or tape* or taping or bandaid* or bandage* or bandaging or dressing* or mucilage* or "sticky past*" or gum or latex or adherent* or adhering or seal*) N3 (remov* or redress* or chang* or selection* or application* or cho#s* or apply* or "device deficienc*" or "adverse event*"))	
Com	bined S	ets	
	S5	S3 AND S4	131
:	S6	S5 Limiters - Published Date: 2012-01-01-2024-03-13; Language: Danish, Dutch, English, Norwegian, Swedish	69

Enseignement Superieur (ABES) Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

CINAHL via EBSCO
Updated search date 2024-03-13 (initial search was made in March 2022-11-10)

earchterm	S	Results				
ain						
S1	(MH "Pain") OR (MH "Pain, Procedural") OR (MH "Pain Management")					
	OR (MH "Pain Measurement")					
S2	TI (pain* or ache* or aching or distress* or suffer* or itch* or					
	discomfort* or anxious or anguished or agony or agonising or anxiety)					
	OR AB (pain* or ache* or aching or distress* or suffer* or itch* or					
	discomfort* or anxious or anguished or agony or agonising or anxiety)					
S3	S1 OR S2					
emoval of	dressings					
S4	(MH "Bandages and Dressings+") OR (MH "Tapes") OR (MH					
	"Transparent Dressings") OR (MH "Adhesives")					
S5	TI (remov* or redress* or chang* or select* or application* or cho?s*	1				
	or apply* or "device deficienc*" or "adverse event*") OR AB (remov*					
	or redress* or chang* or select* or application* or cho?s* or apply* or					
"device deficienc*" or "adverse event*")						
S6	S4 AND S5					
S7	TI (((fastener* or adhesive* or tape* or taping or bandaid* or bandag*					
	or dressing* or mucilage* or "sticky past*" or gum or latex or					
	adherent* or adhering OR seal*) N3 (remov* or redress* or chang* or					
	select* or application* or cho#s* or apply* or "device deficienc*" or					
	"adverse event*"))) OR AB (((fastener* or adhesive* or tape* or taping					
	or bandaid* or bandag* or dressing* or mucilage* or "sticky past*" or					
	gum or latex or adherent* or adhering or seal*) N3 (remov* or redress*					
	or chang* or select* or application* or cho#s* or apply* or "device					
	deficienc*" or "adverse event*")))					
S8	S6 OR S7					
ombined	Sets					
S9	S3 AND S8	2,004				
S10	S9 Limiters - Published Date: 2012-01-01-2024-03-13; Language:	1.246				
	Danish, Dutch/Flemish, English, Norwegian, Swedish					
L.		1				

BMJ Open

Supplementary Table: Assessment of Methodological Quality (JBI Critical Appraisal Tool: Checklist for Qualitative Research).

	Bateman	Docking	Elliott &	Furness	Grocott	Prohet	Roma	Unver	Wang
	(2015)	et al. (2018)	Bluebelle Study Group (2017)	et al. (2019)	et al. (2013)	et al. (2023)	et al. (2021)	et al. (2018)	et al. (2015
1. Is there congruity between the stated philosophical perspective and the research methodology?	NA	N	U	U	Y	Y	U	Y	Y
2. Is there congruity between the research methodology and the research question or objectives?	U	Y	Y	Y	Y	Y	Y	Y	Y
3. Is there congruity between the research methodology and the methods used to collect data?	Y	Y	Y	Y	Y	Y	Y	Y	Y
4. Is there congruity between the research methodology and the representation and analysis of data?	U	Y	Y	Y	Y	Y	Y	Y	Y
5. Is there congruity between the research methodology and the interpretation of results?	Y	Y	Y	Y	Y	Y	Y	Y	Y
6. Is there a statement locating the researcher culturally or theoretically?	N	N	Ν	Ν	N	N	Ν	U	U
7. Is the influence of the researcher on the research, and vice versa, addressed?	N	N	N	N	N	Y	Ν	N	Ν
8. Are participants, and their voices, adequately represented?	Y	Y	Y	Y	Y	Y	Y	Y	Y
9. Is the research ethical according to current criteria or, for recent studies, and is there evidence of ethical approval by an appropriate body?	N	Y	Y	Y	Y	Y	U	Y	Y
10. Do the conclusions drawn in the research report flow from the analysis, or interpretation, of the data?	Y	Y	U	Y	Y	Y	Y	Y	Y

Y = Yes; N = No; U = Unclear; NA = Not Applicable

BMJ Open

BMJ Open

Patients' experiences with the application of medical adhesives to the skin: a qualitative systematic review

Journal:	BMJ Open				
Manuscript ID	bmjopen-2024-089773.R2				
Article Type:	Original research				
Date Submitted by the Author:	07-Oct-2024				
Complete List of Authors:	Hofman, Hannelore; Ghent University Faculty of Medicine and Health Sciences, Department of Public Health and Primary Care, University Centre for Nursing and Midwifery Duljic, Tanja; Orebro universitet, Faculty of Medicine and Health Sciences, School of Health Sciences; Orebro universitet, Faculty of Medicine and Health Sciences, School of Health Sciences, Swedish Centre for Skin and Wound Research Johansson, Sara; Creative Mammals Kottner, Jan; Charite - Universitatsmedizin Berlin, Institute of Clinical Nursing Science, Charité Center for Health and Human Sciences Kinnaer, Lise-Marie; Ghent University, Faculty of Medicine and Health Sciences, Department of Public Health and Primary Care, University Centre for Nursing and Midwifery Beeckman, Dimitri; Ghent University Faculty of Medicine and Health Sciences, Department of Public Health and Primary Care, University Centre for Nursing and Midwifery Beeckman, Dimitri; Ghent University Faculty of Medicine and Health Sciences, Department of Public Health and Primary Care, University Centre for Nursing and Midwifery; Orebro universitet, Faculty of Medicine and Health Sciences, School of Health Sciences, Swedish Centre for Skin and Wound Research Eriksson, Mats; Orebro universitet, Faculty of Medicine and Health Sciences, School of Health Sciences				
Primary Subject Heading :	Nursing				
Secondary Subject Heading:	Qualitative research, Dermatology				
Keywords:	Systematic Review, PAIN MANAGEMENT, Patients				

SCHOLARONE[™] Manuscripts



I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our <u>licence</u>.

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which <u>Creative Commons</u> licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

terez oni

Enseignement Superieur (ABES) Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies



Enseignement Superieur (ABES) Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

Patients' experiences with the application of medical adhesives to the skin

2
3
4
5
6
6
7
8
9
10
10
11
12
13
14
14
15
16
17
10
10
19
20
21
22
22
23
24
25
26
20
27
28
29
30
21
31
32
33
34
25
22
36
37
38
20
29
40
41
42
<u>⊿</u> २
45
44
45
46
47
40
48
49
50
51
50
JZ
53
54
55
56
50
5/
58
59

1

1 Title page

2 3 **TITLE**

4

5 Patients' experiences with the application of medical adhesives to the skin: a qualitative
 6 systematic review
 7

8 AUTHORS

10 Hannelore Hofman^{1,\$}, Tanja Duljic^{2, 3, \$}, Sara Johansson⁴, Jan Kottner⁵, Lise-Marie 11 Kinnaer¹, Dimitri Beeckman^{1,2}, Mats Eriksson^{3, *}

12 13

9

14 **AFFILIATIONS**

15

¹⁶ ¹ University Centre for Nursing and Midwifery, Department of Public Health and Primary
¹⁷ Care, Faculty of Medicine and Health Sciences, Ghent University, Ghent, Belgium
¹⁸ ² Swedish Centre for Skin and Wound Research (SCENTR), Faculty of Medicine and
¹⁹ Health, School of Health Sciences, Örebro University, Örebro, Sweden
²⁰ ³ Faculty of Medicine and Health, School of Health Sciences, Örebro University, Örebro,
²¹ Sweden
²² ⁴ Creative Mammals, Gothenburg, Sweden
²³ ⁵ Institute of Clinical Nursing Science, Charité Center for Health and Human Sciences,

24 Charité-Universitätsmedizin, Berlin, Germany

25 26

27 CORRESPONDING AUTHOR

28

29 *Mats Eriksson, Örebro University, Faculty of Medicine and Health, School of Health

30 Sciences, Fakultetsgatan 1, SE-701 82 Örebro, Sweden

31 Email: mats.h.eriksson@oru.se

32

33

34 OTHER AUTHOR FOOTNOTES

35

³⁶ ^{\$}Hannelore Hofman and Tanja Duljic made equal contributions to this manuscript (joint
 ³⁷ first authorship)

38

39

40 KEYWORDS

41

42 Adhesives; Discomfort; Meta-Aggregation; Pain; Patient Experiences; Skin; Systematic43 Review

44

45

46 WORD COUNT

47

60

48 4.553 words

Page | 1

Patients' experiences with the application of medical adhesives to the skin

49 Abstract

OBJECTIVES

Medical adhesives provide securement of medical devices, facilitate skin protection and allow noninvasive monitoring. Application and removal of medical adhesives can result in pain, dermatitis, trauma or other skin lesions. Understanding patients' experiences when subjected to medical adhesives will contribute to the improvement of clinical routines and the development and improvement of new adhesive technologies. A qualitative systematic review was conducted to identify patients' experiences with the application of medical adhesives to the skin.

DESIGN

61 Qualitative systematic review.

63 DATA SOURCES

64 CINAHL, EMBASE, MEDLINE and PsycINFO were systematically searched for records 65 published between January 2012 and March 2024. Reference lists of systematic reviews and 66 included articles were reviewed.

68 ELIGIBILITY CRITERIA

69 Studies published in Danish, Dutch, English, German, Norwegian and Swedish that collected 70 qualitative data on the experience of patients with the application of medical adhesives to the 71 skin were considered. There were no restrictions regarding age, gender or setting.

73 DATA EXTRACTION AND SYNTHESIS

Study selection, data extraction and quality appraisal was independently conducted by two
 reviewers. The methodological quality of the studies under consideration was assessed using
 the Joanna Briggs Institute Critical Appraisal Tool for Qualitative Research. The extracted data
 was synthesized using meta-aggregation.

RESULTS

Nine studies describing patients' experiences were included. The included studies only reflected experiences with wound dressings. Meta-aggregation of the extracted findings resulted in seven categories that were further synthesized into two synthesized findings: 'Strategies to alleviate pain during dressing changes' and 'Dressing construction and characteristics'. The synthesized findings illustrate that patients experience pain during dressing change and removal and employ various strategies to alleviate this pain.

87 CONCLUSIONS

Patients experience pain and discomfort when dressings are changed or removed. Future research should focus on enhancing both routines and technologies, with a particular emphasis on advancing skin-friendly adhesives to reduce unwanted side effects.

PROSPERO REGISTRATION NUMBER

93 CRD42023457711

BMJ Open

Patients' experiences with the application of medical adhesives to the skin

2	
3	
1	
-	
S	
6	
7	
8	
9	
10	
11	
17	
12	
13	
14	
15	
16	
17	
18	
10	
20	
20	
21	
22	
23	
24	
25	
26	
20	
27	
28	
29	
30	
31	
32	
33	
24	
24	
35	
36	
37	
38	
39	
<u>م</u>	
0 ب 1 ار	
41	
42	
43	
44	
45	
46	
47	
رن مړ	
40	
49	
50	
51	
52	
53	
54	
54	
22	
56	
57	
58	
59	
60	

1

97

100

101

102

103

104

105

106

107 108

94 **KEYWORDS**

Adhesives; Discomfort; Meta-Aggregation; Pain; Patient Experiences; Skin; Systematic
 Review

98 Article summary

99 STRENGTHS AND LIMITATIONS OF THIS STUDY

- Using meta-aggregation as a method for qualitative data synthesis ensures a comprehensive, systematic approach to summarizing patients' experiences.
- Though only four databases MEDLINE, CINAHL, EMBASE and PsycINFO were systematically searched, potentially limiting the comprehensiveness of this review, these are the largest and most relevant databases to the field.
- This systematic review considered studies published in Danish, Dutch, English, German, Norwegian and Swedish, enhancing the comprehensiveness of this review and reducing the risk of language bias.
- The study selection, data extraction and quality appraisal were performed in duplicate, which strengthens the reliability and minimizes potential bias.

Main text

INTRODUCTION

Medical adhesives are defined as adhesives used in medical devices to establish and maintain contact with the body over a period of time (usually by application to the skin). They are a component of a variety of products, including bandages and dressings for wound care, ostomy supplies and patches, adhesive film or tape to secure various catheters, tubes and electronic devices (e.g. adhesives used for securing ECG and EEG electrodes to the skin) [1, 2]. Medical adhesives are frequently used in an array of healthcare settings in all patient groups. From premature babies, who often require medical adhesives to secure nasogastric and ventilation tubes, to patients with an ostomy who frequently have to reapply the adhesive stoma products to their skin. In an acute care facility in the United States, a median of 3.00 – 6.25 adhesive products were used on the skin per patient per day [3].

Patients may experience pain when changing the medical adhesive [4, 5]. The patient's perception of pain is influenced by several factors such as mental and physical health conditions, previous negative experiences, types of medical adhesive used [6]. Therefore it has been recommended to perform a pain assessment at every dressing change [7]. Pain and discomfort can cause chronic stress, which might result in impaired wound healing [8, 9]. Especially in children, pain can lead to emotional trauma and even posttraumatic stress [10, 11], which potentially results in avoidance of trauma reminders and negative moods or cognitions [12]. Pain is defined as "An unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage" [13]. Activation of nociceptors in the epidermis sends signals about potential or actual tissue damage which causes the experience of pain [14]. This starts an autonomic stress response which includes heart rate elevation and metabolic changes. Stress exacerbates the pain experience [14].

Skin damage can cause pain and discomfort in patients [9, 15-17]. Application and removal of medical adhesives to the skin can lead to skin stripping, contact dermatitis, or allergic reactions that may manifest as inflammation associated with itching or pain. Adhesive-related skin injury can lead to infection, delayed wound healing and an increased risk of scarring [2]. Medical adhesive-related skin injury (MARSI) occurs when the adhesive material's adhesion to the skin is stronger than the adhesion between the skin's cells upon removal. This leads to the separation of epidermal layers or the complete detachment of the epidermis from the dermis, observed as erythema, cuts and blisters [7]. Medical adhesive related skin injuries can occur in any patient, but elderly patients and newborns are particularly susceptible [18-20].

Despite the frequent use, medical adhesive related injuries are rarely reported (7). Previous studies have shown that nurses did not take action to prevent pain and skin tearing when carrying out dressing change (17). Understanding the patient's experience with medical adhesives is crucial to determine the focus of further research, to establish policies and to raise awareness among healthcare professionals with the aim of minimizing adverse effects and enhancing patient outcomes during the use of medical adhesives.

- - Therefore, this systematic review aimed to answer the following research question: "What are patients' experiences with the application of medical adhesives to the skin?"

Page 6 of 29

Enseignement Superieur (ABES) Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies.

Patients' experiences with the application of medical adhesives to the skin

METHODS

This systematic review is reported according to the Enhancing Transparency in Reporting the Synthesis of Qualitative Research statement (ENTREQ) criteria [21]. Meta-aggregation was used to synthesize the results based on the guideline from the Joanna Briggs Institute (JBI) [22]. This review is registered with the PROSPERO International Prospective Register of Systematic Reviews (registration number: CRD42023457711). The protocol of this review has been published previously [23].

Search strategy and information sources

A two-step strategy was used to identify relevant studies. First, a systematic search in four electronic databases was conducted: CINAHL (accessed through the EBSCO interface), EMBASE (accessed through Elsevier), MEDLINE (accessed through the Ovid interface) and PsycINFO (accessed through the EBSCO interface). For the initial searches in MEDLINE the concepts 'experience' (keywords include 'pain', 'dermatitis', 'itching', 'pruritus' and 'discomfort') and 'removal of dressings' (keywords include 'adhesive', 'bandage', 'dressing', 'adverse event', 'device deficiency', 'removal', 'change' and 'application') were used. The initial search strategy was customized for each electronic database (see supplementary file 1). Second, the reference lists of relevant systematic reviews and included articles in this review were screened to identify additional studies that were not retrieved through the first strategy.

- **Eligibility criteria**
 - Population and context

This review focused on patients who currently or in the past had medical adhesives applied to their skin. There were no restrictions regarding sex or age.

Phenomena of interest and study design

Studies were included in the review if they collected qualitative data on the experience of patients with the application of medical adhesives to the skin. Both qualitative studies and qualitative data from mixed method studies were considered.

Setting, language and time frame

There were no restrictions regarding settings. Articles published in Danish, Dutch, English, German, Norwegian and Swedish were considered. Due to continuous technological advances in the field of medical adhesives [24-26], this review tried to focus on medical adhesives that are currently still being used in clinical practice by restricting the search period. Therefore, the initial search was conducted to identify records with a publication date between January 2012 and November 2022. The search was repeated in March 2024 to identify any additional studies.

Study selection, data collection and management

All databases underwent individual searches, and the retrieved records were then exported into Covidence software for systematic reviews (Veritas Health Innovation, Melbourne, Australia). Following this, duplicates were identified and subsequently eliminated. The screening of records was conducted independently by two reviewers (HH, TD). In case of disagreement, discussions were held until consensus was reached. If there was no consensus, a third member of the review team was consulted (ME or DB). First, the titles and

Patients' experiences with the application of medical adhesives to the skin

³ 209 abstracts of the records were screened against the inclusion criteria. In a second round, the full text of the selected articles was screened.
 ⁵ 211

212 Assessment of methodological quality

The methodological guality of the studies under consideration was assessed independently by two reviewers (HH, TD). The Joanna Briggs Institute Critical Appraisal Tool for Qualitative Research was used [27]. In cases of disagreement, discussions were held among the reviewers to reach consensus about the methodological quality. If necessary, a third reviewer was involved to resolve remaining disagreements (DB).

13 218 14 219 Data extraction

From the included studies, (a) bibliographic information (lead author, year, title, journal, full citation) (b) study design and sample size, (c) patient demographics, setting and geographical context, (d) description of how the research findings are addressed in the article, (e) method of data collection, (f) method of data analysis, (g) context (product names/brands or type of material of medical adhesives investigated), (h) phenomenon of interest (experience of patients with the application of medical adhesives to the skin) and (i) findings and illustrations were extracted. Definitions of findings and illustrations in meta-aggregation are provided in Table 1: Key Concepts and Terminology in Meta-Aggregation.

Data extraction was independently conducted by two reviewers (HH, TD), with any ambiguities addressed through discussion within the research team. Final data extraction was accomplished through reviewer discussions, ensuring consensus was reached. Another member of the research team (ME, DB) performed quality control of the extracted data on 20% of the included articles.

Key concept	Definition				
Finding	A verbatim extract of the author's analytical interpretation of the results or data [22]				
Illustration	A direct quotation of a participant's voice, fieldwork observation or other supporting data from the paper [22]				
Unequivocal finding	Findings accompanied by an illustration that is beyond reasonable doubt [22, 27]				
Equivocal finding	Findings accompanied by an illustration lacking clear association with the finding and therefore open to challenge [22, 27]				
Unsupported finding	Findings that are not supported by the data [22, 27]				
Category	A brief description of a key concept arising from the aggregation of two or more like findings [22, 27]				
Synthesized finding	An overarching description of a group of categorized findings [22, 27]				

234 Table 1: Key Concepts and Terminology in Meta-Aggregation.

55 235 Data synthesis

 Meta-aggregation was used to summarize the evidence. A level of plausibility was allocated to each extracted finding: unequivocal, equivocal and unsupported. Unsupported findings do not appear in the data synthesis [22, 27].

Patients' experiences with the application of medical adhesives to the skin

Meta-aggregation was completed according to the following steps: (a) each article was read repeatedly to extract all findings from the results and discussion section of the included studies, accompanied by an illustration; next, a level of plausibility was allocated to the extracted finding, (b) findings were summarized into categories based on similarity of concepts and (c) synthesized findings were derived from categories [22, 27]. Category descriptions and synthesized findings were created by a consensus process between three members (HH, TD, DB) of the review team, after repeated reading of the extracted findings.

1124712248Patient and public involvement

No patients were involved in the design or conduct of this systematic review.

16 251 **RESULTS**

17252Screening and search outcome18252Streening and search outcome

The literature search identified 5463 records. No additional records were identified through manual search. After removing duplicates, two reviewers (HH, TD) independently screened the title and abstract of 3102 articles using the software tool Covidence. The eligibility of 160 articles was assessed by screening the full texts. After full text screening 151 studies were excluded. In total, 9 studies were included. The search and selection process is summarized in Figure 1 [28].

25 259 26 260 Description of included studies

261 The included studies were published between 2013 and 2023. Five studies were conducted
262 in the United Kingdom [29-33], and one each in Turkey [34], Brazil [35], Ireland [36] and China
263 [37]. Four studies adopted a phenomenological approach [30, 34, 35, 37]. Seven studies used
264 semi-structured interviews, in-depth interviews or focus groups.

Various methods for data analysis were employed across these studies. Data collection was conducted either directly from patients or through proxies such as parents, healthcare providers, or informal caregivers. Sample sizes across the studies varied, ranging from 7 to 150 participants. All medical adhesives used in the included studies were wound dressings. Table 2 provides a detailed overview of the study characteristics.

Page 9 of 29

BMJ Open Patients' experiences with the application of medical adhesives to the skin

act evaluation qualitative onent	To gain insight into the patient experience, especially in regard to patient choice of	Clinicians asking patients one	No formal data analysis reported	Patients who were	Wound	Patient	CutiMed Siltec
	product.	question and asking them to provide comments to it	(themes were formed from the comments)	care service with low to high-exuding wounds (n= 150)	service of arember trust trust trust relatec		B(order) - also CutiMed Siltec and CutiMed siltec Plus were used in this study
ecific study n is mentioned	To explore the feasibility of the use of analgesic dressings in older adults with leg ulcers, including their perception of current pain management, feasibility of an analgesic dressing, and potential challenges.	Focus group interviews (n= 2)	Framework analysis	Community nurses at the University of Greenwich, who attended a wound care class (n= 15)	Nursing within the Comparison of the Comparison	Proxy: Nurses	Not reported
I-methods rch; phase 1 ed interviews	To produce a comprehensive list of potential issues relating to wound and dressing experience and practical management issues.	Semi-structured interviews	Coding + method of constant comparison to derive themes from the data	Patients who had undergone, or were scheduled to undergo, an abdominal surgical procedure or caesarean section (n= 39)	Two university- teaching NHS hospitats and three district NHS hospitats in the Southwest and Midlands regions of England	Patient	Varied between adhesive coverings (absorptive or non- absorptive) and tissue adhesive as a dressing (brands were not reported)
-scale ative usability using a n-centered ach	To explore patient and staff perceptions of the impact and usability of active and passive virtual reality during painful dressing changes.	Semi-structured interviews (patients) and focus groups (staff)	Semantic analysis for developing themes + constant comparative analysis	Adult inpatients at the local Burns Unit – individual interviews (n= 5) and qualified nurses – focus group (n= 3)	One load Burns ar technolog	Patient and proxy: Nurses	Not reported
ative ipatory rch design	To identify unmet needs within the epidermolysis bullosa population in relation to wound dressings and to translate these needs into design concepts and novel products.	Workshop data enhanced by field notes collected during workshops, visits to participants in their homes or in hospital to observe dressing changes	Brainstorming workshop was to begin the creative and analytic process of formulating innovative design concepts. Findings from these sessions were fed	Patients with epidermolysis bullosa (A total of 4 workshops were held with numbers of participants ranging from 6 to 20)	Hospita epidermolysis bullosa clinics Agence Bibliog	Patient and proxy: Informal caregivers and clinical nurse specialists	Participants used a variety of products to hold the dressings in place such as bandages, tapes and elastic hosiery. (brands were not reported)
	methods ch; phase 1 id interviews scale tive usability using a i-centered ich ative batory ch design	dressings in older adults with leg ulcers, including their perception of current pain management, feasibility of an analgesic dressing, and potential challenges.methods ch; phase 1 ed interviewsTo produce a comprehensive list of potential issues relating to wound and dressing experience and practical management issues.scale tive usability using a i-centered achTo explore patient and staff perceptions of the impact and usability of active and passive virtual reality during painful dressing changes.ative boatory ch designTo identify unmet needs within the epidermolysis bullosa population in relation to wound dressing sand to translate these needs into design concepts and novel products.	dressings in older adults with leg ulcers, including their perception of current pain management, feasibility of an analgesic dressing, and potential challenges.(n= 2)methods ch; phase 1 ed interviewsTo produce a comprehensive list of potential issues relating to wound and dressing experience and practical management issues.Semi-structured interviewsscale tive usability using a i-centered ach patory ch designTo explore patient and staff perceptions of the impact and usability of active and passive virtual reality during painful dressing changes.Semi-structured interviewsative batory ch designTo identify unmet needs within the epidermolysis bullosa population in relation to wound dressings and to translate these needs into design concepts and novel products.Workshop data enhanced by field notes collected during workshops, visits to participants in their homes or in hospital to observe dressing changes	dressings in older adults with leg ulcers, including their perception of current pain management, feasibility of an analgesic dressing, and potential challenges.(n= 2)methods ch; phase 1 rd interviewsTo produce a comprehensive list of potential issues relating to wound and dressing experience and practical management issues.Semi-structured interviewsCoding + method of constant comparison to derive themes from the datascale tive usability using a i-centered uchTo explore patient and staff perceptions of the impact and usability of active and passive virtual reality during painful dressing changes.Semi-structured interviewsSemantic analysis for developing themes + constant comparative analysisative batory ch designTo identify unmet needs within the epidermolysis bullosa population in relation to wound dressings and to translate these needs into design concepts and novel products.Workshop data enhanced by field notes collected during workshops, visits to participants in their homes or in hospital to observe dressing changesBrainstorming workshop was to becreative and analytic process of formulating innovative design concepts. Findings from these sessions were fed	dressings in older adults with leg ulcers, including their perception of current pain management, feasibility of an analgesic dressing, and potential challenges.(n= 2)Greenwich, who attended a wound care class (n= 15)methods ch; phase 1 ch; phase 1 experience and practical management issues.To produce a comprehensive list of potential issues relating to wound and dressing experience and practical management issues.Semi-structured interviewsCoding + method of constant comparison to derive themes from the dataPatients who had undergone, or were scheduled to undergo, an abdominal surgical procedure or caesarean section (n= 39)scale tive usability ich centered ichTo explore patient and staff perceptions of the interviews (patients) and focus groups (staff)Semi-structured interviews (patients) and focus groups (staff)Semantic analysis for developing themes + constant comparative analysisAdult inpatients at the local Burns Unit - individual interviews (n= 5)ative atory ch dressing active 	dressings in older adults with leg ulcers, including their perception of current pain management, feasibility of an analgesic dressing, and potential challenges.(n= 2)Greenwich, who attended a wound care class (n= 15)University of attended a wound care class (n= 15)Oniversity of attended a wound care class (n= 15)Oniversity of attended a wound care class (n= 15)Oniversity of attended a wound care class (n= 15)Two university of attended a wound care class (n= 15)Two university of constant constant constant constant constant constant constant constant constant constant constant constant constant constan	dressings in older adults with leg uccers, including their perception of ourrent pain management, feasibility of an analgesic dressing, and potential challenges.(n= 2)Greenwich, who attended awound care class (n= 15)Universector attended awound care class (n= 15)Universector attended awound care class (n= 15)Patients who had undergone, or were scheduled to undergone, and abdominal surgical procedure or caesarean section (n= 39)PatientPatient management scheduled to undergone, or were scheduled to undergone, and abdominal surgical procedure or caesarean section (n= 39)Patient the abdiminal surgical procedure or caesarean section (n= 39)Patient and provide a three district HS bositat and three district HS <br< td=""></br<>
BMJ Open Patients' experiences with the application of medical adhesives to the skin

						t, ir		
				back to the user group through subsequent workshops.		773 on 1 No cluding for		
Probst et al. (2023), Ireland	Qualitative, descriptive design	To describe individuals' experiences for chronic wound-associated pain	Semi-structured interviews (telephone interviews)	Thematic analysis following Braun and Clarke framework	Adults with chronic wounds who experience chronic wound-associated pain (n= 13)	CommunityEnseignem	Patient	'Dressing' and 'VAC dressing' (brands were not reported)
Roma et al. (2021), Brazil	Qualitative, exploratory research	To understand the perception and attitude of parents of newborns admitted to a neonatal unit about their children's pain.	Semi-structured interviews	Thematic analysis	Parents of 15 premature newborn babies with a gestational age of 24 to 36 weeks and chronological age of 8 days to 5 months and 3 days (n= 20)	Neona (State Service (A) Deds) of a unit experied hospitation of a data hospitation of a data data mile mile data mile mile mile data mile mile data mile mile mile data mile mile data mile mile data mile mile data mile data mile data mile data data data data data data data dat	Proxy: Parents of newborn children	Tape (brands were not reported)
Unver et al. (2018), Turkey	Qualitative, descriptive design (phenomenology)	To describe patients' pain experience, pain- coping skills, and the effect of negative pressure wound therapy-related pain on daily life activities following abdominal surgery.	Semi-structured interviews	Colaizzi's method of phenomenological data analysis	Patients receiving Negative Pressure Wound Therapy in the abdominal area for the first time (n= 12)	Surgican of a univer, y he pital Al training, and	Patient	"Adhesive wrap" with foam dressing underneath (brands were not reported)
Wang et al. (2015), China	Qualitative, exploratory design (phenomenology)	To investigate medical workers' understanding of current pain management during dressing among children with burns and their attitudes toward the application of 50% nitrous oxide in pain management.	Semi-structured in-depth interviews	Content analysis and open coding	Doctors and nurses (n=7)	Burn center of a tertiary Hospital in Easter Transform June China technologies. 2025 at	Proxy: Doctors and nurses	Not reported
Table 2: (Characteristics of	Included Studies.				Agence Bibliograph		
Page 9		F	anian ask has 11		/site /sle sut / suid / lt	que c		
		For peer re	eview only - nttp://	binjopen.binj.com	/site/about/guideline			

Patients' experiences with the application of medical adhesives to the skin

Assessment of methodological quality

The quality appraisal of the nine studies showed varying quality levels. All studies used suitable methodologies, but none addressed the researchers' cultural or theoretical background, and only one noted the potential influence of researchers on the outcomes [36]. To ensure a comprehensive synthesis of the existing evidence, articles were not excluded based on low quality. Supplementary file 2 provides a detailed overview of the assessment of methodological quality.

Findings

Patients and health care providers reported that patients experienced pain during dressing removal and dressing changes [30, 32-34, 36, 37]. From the 9 included studies, 43 findings were extracted after repeated reading of the text. 24 of the 43 extracted findings were supported by an illustration and were therefore allocated unequivocal or equivocal as level of plausibility. The supported findings were then aggregated into 7 categories, based on similarity in meaning [27]. These categories were clustered further into 2 synthesized findings based on similarity of concepts: 'Strategies to alleviate pain during dressing changes' and 'Dressing construction and characteristics. Table 3 provides an overview of the meta-aggregation of the extracted supported findings.

The category 'Emotional response to pain caused by dressing changes' could not be clustered into any synthesized finding, since a synthesized finding has to consist of at least two categories [22, 27]. Current or previous experiences of pain during dressing change can trigger an emotional response in patients. Health care providers described noncompliance with leg ulcer treatment in patients due to anxiety and anticipated pain based on previous painful experiences. "If you tell them we need to increase their visits they don't like it because obviously they know they're going to get pain ... it kind of puts them off and then they become non-compliant" [30]. Patients reported that distraction by use of virtual reality gave them a sense of control over the situation, which resulted in a decrease in pain during dressing change. "Something as trivial as a video was actually quite empowering for me because I could take myself away" [32].

BMJ Open Patients' experiences with the application of medical adhesives to the skin

Finding	Cluding Category	Synthesized finding
Patients who were provided anesthesia before debridement and dressing changes reported they did not feel any pain. (UE) [34]	ng for	
The majority of participants reported that pain is at its worst during dressing removal and changing. Patients therefore require pain relief that will last beyond the point of removal. (UE) [30]	rember Enseij	
One of the strategies was to take painkillers as prescribed by the physician, even though they sometimes caused some side effects such as stomachache or illusions. (UE) [36]	2024. gneme	
Many tissue viability nurses recommend that patients take additional analgesics prior to appointments for dressing changes. (UE) [30]	・ Anglesia is a strategy to 変絶感iate pain during 気気をいて、 ので、 ので、 ので、 ので、 ので、 ので、 ので、 ので	Stra
Some participants indicated providing recommendations to their care network about research or dressings on managing wound-associated pain. (E) [36]	haded fr	ategies t
Raising awareness about chronic wound-associated pain was another recommendation. Some participants highlighted the importance of immediately referring the wound patients to a pain manager if they mention having pain. (UE) [36]	rom htt ABES)	io allevi
Medical workers agree that 50% nitrous oxide is applicable to dressing analgesia for children with burns. (UE) [37]	, <u>,</u>	ate p
A key factor in reducing pain and increasing tolerance of wound care seemed to be the degree of distraction created by VR. (UE) [32]	mjopen	ain duri
Patients were unanimous that they had achieved good levels of distraction (and no nausea) in the active VR. Some spoke of awareness of pain and of what the nurses were doing. (UE) [32]	Views a strategy to alleviate pain during	ng dress
Without this distraction, normal behavior involved being drawn to and focusing on the wound and wound care, which increased pain. Not watching meant reduced pain. (UE) [32]	similar on	sing cha
More than 10% of neonates hospitalized in the four units analyzed in the survey, in 2011, did not receive any analgesia in the first three postoperative days. Alisson's speech drew attention to other painful stimuli. (UE) [35]	une 13, :	anges
Participants thought there was a large gap between the current situation and their expectations. They expected to perform dressing with children's cooperation under noninvasive analgesia. They expected better measures to reduce the pain during dressing. (UE) [37]	Strategies to alleviate pain and suffering in children carsed by dressing	
For the pain suffered by children during dressing of burn wounds, all participants showed sincere sympathy: we provided a score of 0–10 to measure their degree of sympathy. All of them scored 10 (sincere sympathy). (UE) [37]	Bit	
	liogr	
Page 11	aphiqu	
For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtm	n o D	

age 13 of 29	BMJ Open	l by cc	
	Patients' experiences with the application of medical adhesives to	ÿy∰eskin ∰angeskin	
	The main causes of dressing change pain were swift wrap removal and the resulting traumatized skin. (UE) [34]	9773	
	Nine participants specified having procedural pain and the pain level was influenced by their activities of daily living. (UE) [36]	Procedures to remove	
	Dressing removal: "I just completely soaked it [adhesive dressing] in the shower then my husband just took it off for me. But it was, it was really easy. Much easier than I thought.' (Patient, adhesive dressing)". (UE) [31]	vembe	
) 1	Atraumatic application and removal, skin protection, good adherence with product remaining in place, comfort of product in place. (E) [29]	e grant acteristics of an	Dres
<u>2</u> 3	It is essential that a dressing designed for leg ulcers only impacts on the wounds itself. (UE) [30]		cha
1	Wound comfort (UE) [31]	nloa uperi	cons
5 6	Reactions to the dressing (UE) [31]	Adverse reactions to the	eristic
7 8 9	Participants noted that the amount of exudate and associated odour and leakage meant dressings required frequent changes, which were painful and time consuming, also evidenced in the way that pain was described was the 'pain' experienced by the carers. (UE) [33]	a mining (ABES) .	ion and os
) 1 2	One of the key problems reported with treating leg ulcers was noncompliance by the patients, often related to their anxiety around anticipated pain. (E) [30]	//bmjoj	
- 3 1 5	Most spoke of positive emotions in response to the VR. The active VR in particular was "fun," "challenging," and "enjoyable" (various pts). Ns1 expressed surprise at participants' apparently pleasurable engagement with the technology. She spoke about "laughter," an outcome rarely associated with painful dressing changes. (UE) [32]	Entertional response to	
, ,)	Two described feeling they could control part of the otherwise passive and traumatic dressing change experience when using VR. Having control meant retaining one's "humanity." The sense of having some control over the situation, along with the distraction and reduced pain, helped some patients manage their own emotional responses to the experience.	pate caused by dressing sichanges ס ביום ביום ביום ביום ביום ביום ביום ביום	/
) I	shameful, humiliating, and disempowering. (UE) [32]	e 13, hnok	
2	UE = unequivocal finding, E = equivocal finding, VR = Virtual Reality	202	
3 4 304	Table 3: Overview of Meta-Aggregation of the Extracted Findings.	e at /	
5 5 7 8 9 0		vgence Bibliograp	
l 2	Page 12	shiqu	
- 3 4 5	For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtm	ni de	

Enseignement Superieur (ABES) Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

Patients' experiences with the application of medical adhesives to the skin

Synthesized findings

Strategies to alleviate pain during dressing changes

The synthesized finding Strategies to alleviate pain during dressing changes emerged from four categories: a) 'analgesia is a strategy to alleviate pain during dressing changes', b) 'Virtual Reality (VR) is a strategy to alleviate pain during dressing changes', c) 'strategies to alleviate pain and suffering in children caused by dressing changes and d) 'procedures to remove dressings' (Table 3).

a) Analgesia is a strategy to alleviate pain during dressing changes

Analgesia and anesthesia were described as strategies to alleviate pain during dressing changes [30, 34, 36, 37]. Patients reported that being provided anesthesia before the dressing changes reduced the experienced pain. "On the first changing, they made me sleepy (with narcotics) and I didn't feel anything then the wraps were taken off the skin. They didn't anaesthetize me the second time, and it was much worse" [34]. Health care providers similarly recommended patients to take additional analgesics prior to dressing change appointments in order to reduce pain during dressing [30, 36, 37], even though they sometimes triggered side effects [36]. Some patients gave recommendations about research on dressings or pain management to their care network. "Olivia suggested focusing research on pain relieving dressings rather than drugs". Some also indicated the importance of timely referral to a pain manager [36].

b) Virtual Reality (VR) is a strategy to alleviate pain during dressing changes

Additionally, utilizing virtual reality (VR) was described as a strategy to alleviate pain during dressing changes. The use of VR distracted patients from focusing on the wound care and accompanying pain during dressing change. "Before you were thinking, it hurts, because watching them do it makes it worse" [32].

Strategies to alleviate pain and suffering in children caused by dressing changes C)

Parents and health care providers reported pain and suffering in neonates and children during dressing change [35, 37]. "The day I most saw her crying in pain was when she removed the tape" [35]. Even though pain during dressing change is a known problem, health care providers reported a gap between the current situation and their expectations regarding strategies to alleviate pain during dressing change in children. Patients received too little or even no pain relief [35, 37]. "Analgesics available for children are guite few, children with burns cry all the time during the dressing, and we need available drugs or methods to relieve their pain" [37].

d) Procedures to remove dressings

Specific procedures for removal of dressings were described [31, 34]. Unver et al. (2018) reported that swift removal of adhesives and the resulting skin trauma were the main causes of pain during dressing changes. Patients soaked the adhesive dressings in the shower to aid dressing removal and reduce removal pain. "I just completely soaked it [adhesive dressing] in the shower then my husband just took it off for me. But it was, it was really easy. Much easier than I thought" [31]. Patients experienced procedural pain and indicated that activities of the daily living influenced pain levels. "Maybe sometimes with dressing changes, the worst pain I had was with the VAC dressing (Negative Pressure Wound Therapy)" [36].

Patients' experiences with the application of medical adhesives to the skin

359 Dressing construction and characteristics

The two categories a) 'characteristics of an atraumatic dressing' and b) 'adverse reactions to the dressing' have been synthesized on the basis that they both describe the constitution of the dressings used in the studies. This synthesized finding demonstrates that dressings should be designed in a way that facilitates easy removal and minimizes discomfort during wear.

a) Characteristics of an atraumatic dressing

Atraumatic application and removal were described as a characteristic of an atraumatic dressing. "Those dressings helped my mum's legs in that they didn't hurt here when the nurse took them off" [29]. Additionally, skin protection of the peri-wound skin, good adherence, and comfort during wear of the adhesive dressing were highlighted as features of atraumatic dressings. "Very important not to have them stuck on the area that has just been healed, and it is very difficult to take it off without hurting the wound again, and I think that is terribly important" [29, 30].

b) Adverse reactions to the dressing

To minimize discomfort during dressing wear, potential adverse reactions to dressings must be considered when choosing an adhesive dressing. Frequent dressing changes due to leakages caused by highly exudating wounds, were reported as very painful. "*It is excruciating when the dressings keep coming on and off and she is in unbearable pain (reported by carer)*" [33]. Itching and allergic reactions to the adhesives used were also described as uncomfortable adverse reactions to an adhesive dressing. "*I've now got really itchy where the plaster goes. Which is uncomfortable*" [31].

DISCUSSION

This systematic review aimed to synthesize patients' experiences with the application of medical adhesives to the skin. This systematic literature search only retrieved studies that included findings on wound dressings. No records reporting patients' experiences with other types of medical adhesives such as electrocardiography (ECG) electrodes, intravenous (IV) catheter patches, securement for medical devices, ostomy supplies et cetera were identified. All included studies in this review reported experiences with the changing and removal of dressings. No findings described patient experiences with the application and wear of adhesive dressing.

The results imply that patients experience pain and discomfort during dressing change and removal [30, 32-34, 37]. Awareness among health care providers is important since a single painful experience can change nociceptive pathways and induce sensitization. This is a process that involves a reduction in the threshold of activation and an increased response rate to damaging stimulation [38, 39]. Pain is a personal experience, influenced by biological, psychological and social factors to varying degrees [13]. A clinical tool predicting severe pain (Numeric Rating Scale \geq 8) during wound dressing changes using clinically available wound and patient factors, was developed [40, 41]. Expected pain intensity (p < 0,001; OR = 1,50), resting pain intensity (p < 0.001; OR = 1.19) and type of dressing (p < 0.05; OR 1.19 to 3.62) are significant predictors for experiencing high intensity pain during wound care procedures (overfitting-corrected AUC = 0,826). Sex, age, ethnicity chronic pain, opioid

Page | 14

Enseignement Superieur (ABES) Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies.

Patients' experiences with the application of medical adhesives to the skin

tolerance, anxiety, depression and pain catastrophizing were not significant predictors [41]. Pain catastrophizing is measured by using "The pain catastrophizing scale" and the term is frequently used since the factors included in the measurements are a comprehensive predictor of pain. However, this term is controversial since people with chronic pain have reacted negatively towards it as the term diminishes the importance of the medical reason behind their pain and focuses too much on psychological factors, which in the end can lead to insufficient care [42]. Through the use of neurological imaging, cortical and subcortical pathways have been identified that are activated when the patient expects pain. This is called anticipatory pain [43]. Patients experiencing anxiety in relation to anticipatory pain can develop a reduced pain tolerance and lead to an increased self-reported pain intensity, resulting in more painful future procedures [40, 43, 44].

Along with describing experiences, patients and proxies describe the need for strategies to alleviate the pain and discomfort experienced during the application of dressings to the skin [30-32, 34, 35, 37]. Both pharmacological and non-pharmacological interventions to alleviate dressing-related pain were described. Health care professionals describe the lack of an appropriate analgesic regimen for neonates needing their burn wounds dressed [37]. Many infants get too little or no pain relieving interventions despite the existence of validated pain assessment tools and recommended actions for pain management when conducting medical procedures. The recommendation for neonates is both pharmacological measures, such as acetaminophen, opioids and local topical agents, and non-pharmacological measures, such as breastfeeding, skin-to-skin contact and sucrose solution together with non-nutritive sucking [45]. In addition, distraction by virtual reality was described as a non-pharmacological intervention to reduce dressing change-related pain [32]. Immersive virtual reality has been demonstrated to alleviate pain across various medical procedures, including dressing changes in patients with hand injuries [46]. For patients to take prescribed analgesics before dressing changes and for nurses to recommend patients to take analgesics before dressing changes was also part of the synthesised finding [30, 36]. Recommended pharmacological strategies for treating pain or breakout pain when changing dressings include increasing the dose of the analgesic already prescribed, adding another faster-acting pain medication or reducing the time in between doses [47].

Health professionals should improve their communication with patients about the risks related to adhesive wound dressing use. They should try to minimize pain during dressing removal and the occurrence of medical adhesive-related skin injuries [7]. It is important for health professionals to understand the unique characteristics of an adhesive wound dressing for informed decision-making regarding the selection of the dressing [48]. Dressing characteristics for atraumatic dressing removal were described in a few studies [29-33]. Patients with atraumatic dressings using a silicone contact layer applied to their skin report significantly lower pain scores (p < 0.01) when compared to traditional adhesives (i.e. adhesive foams, hydrocolloids and other dressings) [49]. It is also important for health professionals to have knowledge about the skin as well as knowledge about application and removal techniques for adhesive wound dressings and medical adhesives in general to prevent unnecessary damage to the patient [48]. The barrier function of the skin can be damaged as a result of single or repeated application of adhesives, despite a reduction in adhesive strength during prolonged dressing wear [50].

Patients' experiences with the application of medical adhesives to the skin

Methodological considerations

This review used meta-aggregation to synthesize the findings. No member of the research team had previous experience with this data synthesis method. Therefore, meta-aggregation was performed independently by two members of the research team (HH, TD). Extracted findings were synthesized to a higher level of abstraction until consensus was reached. When necessary, a third member of the research team (DB) was consulted.

The methodological quality of the included studies was assessed, but no studies were excluded for low quality. However, all studies lacked reflexivity regarding researchers' cultural and theoretical backgrounds, with only one study addressing the potential influence of the researchers on the outcomes. Methodological guidelines for qualitative research recommend that researchers reflect on their own position, biases, and assumptions in their writings before and during the research process to minimize bias [51]. The lack of a statement on reflexivity in the primary studies may indicate bias, as readers of these articles are not informed about the authors' perspectives and prejudices regarding the concept of pain before they started the analysis process.

473 Strengths and limitations

The systematic review only included studies containing qualitative data to explore patients' experiences with the application of medical adhesives to the skin, which resulted in only nine eligible studies. Employing quantitative studies in addition to gualitative articles might have provided interesting insights on pain and discomfort scores of patients while adhesive dressings are being removed. However, conducting a mixed-method review has several limitations, including difficulties of comparing results from these different paradigms is difficult and extends the time to complete the review [52].

Enseignement Superieur (ABES) Protected by copyright, including for uses related to text and data mining, Al training, and similar technologies.

For this review, only four databases were systematically searched. MEDLINE, CINAHL and EMBASE are among the largest and most relevant databases in the field of nursing science. PsycINFO primarily covers psychology, behavioral science and mental health. These databases were selected to ensure comprehensive coverage of primary studies containing qualitative data on patients' experiences with the application of medical adhesives to the skin. Their scope makes them the optimal choice for capturing the most relevant studies for the data synthesis.

Only studies published between January 2012 and March 2024 were considered. The initial search for this systematic review was conducted in November 2022, focusing on articles published between January 2012 and November 2022. The search was updated in March 2024 to capture any new publications on the topic of this review. In light of the ongoing advancements in medical adhesives and technological innovations [24-26], this study aimed to focus on adhesives currently used in clinical practice. Additionally, during the last ten years, pain research has advanced significantly [13]. Limiting the timeframe from January 2012 to March 2024 enabled incorporation of the latest knowledge and developments in the field.

The study characteristics of the included studies, such as age, setting and country,
 were heterogeneous. Since only a limited amount of findings could be extracted, it was
 not possible to identify potential cultural differences in the reported findings.

Patients' experiences with the application of medical adhesives to the skin

Studies that were published in languages other than Danish, Dutch, English, German,
Norwegian or Swedish were not screened through the search strategy. This may have
led to the exclusion of relevant articles published in another language.

Four of the included studies [30, 32, 34, 37] did not specify the used dressing type or
brand. No additional information on dressing type or brand was retrieved by contacting
the authors. As a result, not all of the published information could be synthesized fully.

This systematic review describes patients' experiences with the application of dressings on various wound types: burn wounds [32, 37], chronic leg ulcers [30], surgical wounds [31, 34] and epidermolysis bullosa [33]. Pain can also be caused by tissue damage [53]. Reported experiences of pain and discomfort with the application of medical adhesives to the skin might consequently be obscured by wound pain [36, 512 41].

513 This study did not involve patients or the public in its conceptualization, design or 514 conduct. This qualitative systematic review is part of a larger research project, the 515 TAPE-research project, which consists of four phases. In the subsequent phases of 516 this project, patients will be involved in refining the research objectives to ensure the 517 concerns of patients who use medical adhesives are addressed.

518 Implications for research and clinical practice

Future research should focus on exploring routines to reduce unwanted side effects with medical adhesive use in clinical practice. This will guide improvement of adhesive technologies, the establishment of policies, and raise awareness among healthcare professionals regarding the pain and discomfort related to medical adhesives application to the skin.

Pain and discomfort related to the application, presence and removal of medical adhesives are often overlooked. A lack of established policies and training exacerbates the issue. Pharmacological interventions designed to alleviate pain and discomfort related to the application, use and removal of medical adhesives often result in unwanted side effects. Nonpharmacological interventions offer alternatives but costs of necessary equipment, such as virtual reality materials, may result in a limited availability. Establishing policies and raising awareness among healthcare professionals is needed [5, 17]. This can be done through an educational effort as well as raising awareness on a higher level in the healthcare system, for example questioning the materials being bought for hospital wide use. When cost is the deciding factor, it is important to evaluate whether different brands offer comparable adhesion and skin protection.

Future research should focus on enhancing both routines and technologies, with a particular emphasis on advancing skin-friendly adhesives to reduce unwanted side effects. Interviewing patients about their experiences and doing a narrative description of specific aspects of the dressing change process could be of value. Since medical adhesives are frequently used in all patient groups and the findings of this study indicate that patients experience pain when dressings are being removed, future qualitative research should explore patient experiences with other types of medical adhesives (ECG electrodes, IV patches, et cetera).

57545Future dressing development should focus on material science, cell biology an58546intelligent technology to develop multi-purpose dressings that can further improve60547wound management [54]. In some cases, there will be a need for medical adhesives

Page | 17

Patients' experiences with the application of medical adhesives to the skin

that adhere more strongly to the skin to prevent dislocation of life-saving medical
devices such endotracheal tubes and intravenous catheters in an intensive care
setting.

551 CONCLUSION

The meta-aggregation performed in this study implies that patients do experience pain and discomfort when wound dressings are changed or removed. The synthesized findings of this review 'strategies to alleviate pain during dressing changes' and 'dressing construction and characteristics' can serve as a guide to improve clinical io. ve dres. nd prevent . routines for adhesive dressing use, avoid pain and discomfort while changing adhesive dressings [4, 5] and prevent emotional trauma and post-traumatic stress in children [10, 11].

Patients' experiences with the application of medical adhesives to the skin

Footnotes

561 AUTHOR CONTRIBUTIONS

HH and TD contributed equally to this paper. All authors contributed to the conception of the research question and the writing of the protocol. HH, DB, SJ, JK, LMK, and ME contributed to the development of search strategies, eligibility criteria, and methodology for data synthesis. All authors contributed to the draft protocol and approved the final version of the protocol. HH, TD, and ME worked in duplicate to review the titles and abstracts of all materials obtained using the search strategy to exclude articles that do not meet the eligibility criteria. HH and TD evaluated potentially eligible studies through full-text screening and excluded non-eligible studies, documenting the reason for exclusion. HH and TD independently extracted data from the included studies. ME and DB checked the quality on 20% of the extracted data of the included articles. HH and TD synthesized the data and drafted the manuscript. All authors read, provided feedback, and approved the final manuscript. ME is responsible for the overall content as guarantor.

575 COMPETING INTERESTS

576 None declared.

577 FUNDING

578 This systematic review is supported by Mölnlycke Health Care AB, grant number 579 68003673. Mölnlycke Health Care AB was not involved in any other aspect than the 580 funding of this systematic review. The funder had no input on the interpretation or 581 publication of the study results.

DATA SHARING STATEMENT

All data relevant to the study are included in the article or uploaded as supplementary
 information.

587 ETHICS APPROVAL

588 This systematic literature review uses published literature and did not recruit 589 participants. Therefore, no formal ethical approval or consent was necessary. This 590 systematic review protocol is published in an open access journal to increase 591 transparency of the research methods used.

593 ACKNOWLEDGEMENTS

Mölnlycke Health Care AB provided financial support to conduct this systematic review.
We would also like to thank Samal Al Gilani, RN, PhD, for participating in the planning
of the project and in some additional screening.

Patients' experiences with the application of medical adhesives to the skin

2		
3 4	599	References
5	600	
6	601	1. Medical device adhesives, sealants and coatings for the medical device
7	602	industry 2024 [Available from: https://www.medicaldevice-network.com/buyers-
8	603	guide/medical-adhesives/
9	604	2 McNichol L Lund C Rosen T Grav M Medical adhesives and patient safety.
10	605	state of the science: consensus statements for the assessment prevention and
12	606	treatment of adhesive-related skin injuries Orthon Nurs 2013:32(5):267-81
13	607	3 Farris MK Petty M Hamilton I Walters SA Flynn MA Medical Adhesive-
14	608	Related Skin Injury Prevalence Among Adult Acute Care Patients: A Single-Center
15	609	Observational Study I Wound Ostomy Continence Nurs 2015:42(6):589-98
16	610	4 Kammerlander G Eberlein T Nurses' views about pain and trauma at dressing
17	611	changes: a central European perspective. I Wound Care 2002:11(2):76-9
18	612	5 Hollinworth H. Collier M. Nurses' views about nain and trauma at dressing
19 20	613	changes: results of a national survey. I Wound Care 2000;9(8):369-73
20	614	6 Woo KV Unravelling nocebo effect: the mediating effect of anxiety between
22	615	anticipation and pain at wound dressing change. Journal of clinical nursing
23	616	$2015 \cdot 24(13 \ 14) \cdot 1075 \ 84$
24	617	7 Eumarola S. Allaway P. Callaghan P. Collier M. Downie F. Geraghty I. et al.
25	619	7. Tullarola S, Allaway K, Callaglian K, Collici M, Downie F, Octagnity J, et al.
26	610	wound care, 2020;20(Sup2c):S1 S24
2/	619	Would cale. 2020,29(SupSc).SI-S24. Matauzalii K. Untan D. Wound tractment and noin management: a strengful
20 29	620	5. Matsuzaki K, Opton D. wound treatment and pain management. a suessiul
30	621	ume. Int wound J. 2013,10(0):038-44.
31	622	9. Reeven G, Anders T, Morgan T. Improving patients experience of dressing
32	623	removal in practice. Journal of Community Nursing. 2010;50(5).
33	624	10. Hildenbrand AK, Marsac ML, Daly BP, Chute D, Kassam-Adams N. Acute
34	625	Pain and Posttraumatic Stress After Pediatric Injury. J Pediatr Psychol.
35	626	2016;41(1):98-107.
30 37	627	11. Holley AL, Wilson AC, Noel M, Palermo IM. Post-traumatic stress
38	628	symptoms in children and adolescents with chronic pain: A topical review of the
39	629	literature and a proposed framework for future research. Eur J Pain. 2016;20(9):13/1-
40	630	
41	631	12. American Psychiatric Association. Diagnostic and Statistical Manual of
42	632	Mental Disorders 5ed. Arlington, USA: American Psychiatric Publishing; 2013.
43	633	13. Raja SN, Carr DB, Cohen M, Finnerup NB, Flor H, Gibson S, et al. The
44	634	revised International Association for the Study of Pain definition of pain: concepts,
45 46	635	challenges, and compromises. Pain. 2020;161(9):1976-82.
47	636	14. Werner M, Leden I. Smärta och smärtbehandling: Liber; 2010.
48	637	15. Bianchi J. Protecting the integrity of the periwound skin. Wound Essentials.
49	638	2012;1:58-64.
50	639	16. Collier M. Minimising pain and medical adhesive related skin injuries in
51	640	vulnerable patients. British Journal of Nursing. 2019;28(15):S26-S32.
52	641	17. Kim JY, Kim NK, Lee YJ. A descriptive study of Korean nurses' perception of
53 54	642	pain and skin tearing at dressing change. Int Wound J. 2016;13 Suppl 1(Suppl 1):47-
55	643	51.
56	644	18. August DL, New K, Ray RA, Kandasamy Y. Frequency, location and risk
57	645	factors of neonatal skin injuries from mechanical forces of pressure, friction, shear
58	646	and stripping: a systematic literature review. Journal of Neonatal Nursing.
59	647	2018;24(4):173-80.
60		

Page | 20

Patients' experiences with the application of medical adhesives to the skin

2		
3	648	19. Cutting K. Impact of adhesive surgical tape and wound dressings on the skin,
4	649	with reference to skin stripping. Journal of Wound Care. 2008;17(4):157-62.
5	650	20 Jones L Bell D Hodgson C Mohamud L Stephan-Haynes J Callaghan R et
0 7	651	al Case study series: Lifteez aerosol and wipes for the prevention and management of
2	652	MARSI Wounds UK 2018:14(5)
9	653	21 Tong & Flemming K McInnes F Oliver S Craig I Enhancing transparency
10	654	in reporting the synthesis of qualitative research: ENTREO, BMC Mod Pas
11	654	Mathadal 2012:12:191
12	655	Methodol. 2012,12.181.
13	636	22. Lockwood C, Polliu K, Munii Z, Kittenineyei L, Sainond S, Bjelluni M, et al.
14	657	Chapter 5: systematic reviews of qualitative evidence. Afomataris E LC, Porritt K,
15	658	Plila B, Jordan Z, editor. Joanna Briggs Institute, 2024.
16 17	659	23. Horman H, Beeckman D, Duijic I, Al Gliani S, Jonansson S, Kottner J, et al.
17	660	Patients' experiences with the application of medical adhesives to the skin: a
19	661	qualitative systematic review protocol. BMJ Open. 2023;13(6):e0/3546.
20	662	24. Karp JM, Langer R. Dry solution to a sticky problem. Nature.
21	663	2011;477(7362):42-3.
22	664	25. Zulkowski K. Understanding moisture-associated skin damage, medical
23	665	adhesive-related skin injuries, and skin tears. Advances in skin & wound care.
24	666	2017;30(8):372-81.
25	667	26. Hwang I, Kim HN, Seong M, Lee SH, Kang M, Yi H, et al. Multifunctional
20	668	smart skin adhesive patches for advanced health care. Advanced healthcare materials.
27	669	2018;7(15):1800275.
29	670	27. Lockwood C, Munn Z, Porritt K. Qualitative research synthesis:
30	671	methodological guidance for systematic reviewers utilizing meta-aggregation. JBI
31	672	Evidence Implementation. 2015;13(3):179-87.
32	673	28. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD,
33	674	et al. The PRISMA 2020 statement: an updated guideline for reporting systematic
34	675	reviews. Bmj. 2021;372:n71.
35	676	29. Bateman SD. 150 patient experiences with a soft silicone foam dressing. Br J
30	677	Nurs. 2015;24(12):S16, s8-23.
38	678	30. Docking R, Boateng J, Catanzano O, Schofield P. A Preliminary Study of Pain
39	679	Relieving Dressings for Older Adults With Chronic Leg Ulcers From the Provider's
40	680	Perspective: A Qualitative Study. J Pain Palliat Care Pharmacother. 2018;32(2-3):71-
41	681	81.
42	682	31 Elliott D The Bluebelle Study Group Developing outcome measures
43	683	assessing wound management and national experience: a mixed methods study BMJ
44	684	Onen 2017 ^{.7} (11) [.] e016155
46	685	32. Furness PJ, Phelan I, Babiker NT, Fehilv O, Lindley SA, Thompson AR
47	686	Reducing Pain During Wound Dressings in Burn Care Using Virtual Reality: A Study
48	687	of Perceived Impact and Usability With Patients and Nurses I Burn Care Res
49	688	$2019 \cdot 40(6) \cdot 878 \cdot 85$
50	680	33 Grocott P. Blackwell R. Weir H. Pillav F. Living in dressings and bandages:
51	600	findings from workshops with people with Endermolysis bullosa. Int Wound I
52	601	$2012 \cdot 10(2) \cdot 274.84$
53	691	2015,10(5).274-04. 24 Univer S. Evi S. Ortken 7K. A Descriptive Qualitative Study to Explore the
54 55	602	Dain Experience During Negative Programs Wound Thereasy for Destauraical
56	693	Abdominal Wounds, Ostomy Wound Manage, 2019;64(12):22,49
57	094	Abuommar wounds. Usionny wound Manage. 2018;04(12):38-48.
58	695	55. Koma I M, Carvaino Lam Z, Garcia Marques AC, Uchoa Lopes Pereira M,
59	696	Motta E, Lamy-Filho F. Perception and attitude of parents towards newborn pain in
60	697	neonatal unit. Revista de Pesquisa: Cuidado e Fundamental. 2021;13(1).

Page | 21

BMJ Open

Patients' experiences with the application of medical adhesives to the skin

2		
3	698	36. Probst S, Gschwind G, Murphy L, Sezgin D, Carr P, McIntosh C, et al.
4	699	Patients 'acceptance' of chronic wound-associated pain - A qualitative descriptive
5	700	study. J Tissue Viability. 2023:32(4):455-9.
0 7	701	37 Wang HX Li YX Zhou RZ Zhao II Medical workers' cognition of using
/ Q	702	50% nitrous ovide in children with hurns: a qualitative study. Burns
0 0	702	$2015 \cdot 41(6) \cdot 1275 \cdot 80$
5 10	703	2015,41(0).1275-00.
11	/04	58. DI Maio G, Vinano I, hardi CK, Messina A, Monda V, Iodice AC, et al.
12	705	Mechanisms of Transmission and Processing of Pain: A Narrative Review. Int J
13	706	Environ Res Public Health. 2023;20(4).
14	707	39. Li W, Gong Y, Liu J, Guo Y, Tang H, Qin S, et al. Peripheral and Central
15	708	Pathological Mechanisms of Chronic Low Back Pain: A Narrative Review. J Pain
16	709	Res. 2021;14:1483-94.
17	710	40. Gardner SE, Abbott LI, Fiala CA, Rakel BA. Factors associated with high pain
18	711	intensity during wound care procedures: A model. Wound Repair Regen.
19	712	2017;25(4):558-63.
20	713	41 Gardner SE Bae J Ahmed BH Abbott LJ Wolf JS Hein M et al A clinical
21	714	tool to predict severe pain during wound dressing changes Pain 2022.163(9):1716-
22	715	27
25 24	715	42 Sullivan MIL Trinn DA Pain Catastronhizing: Controversion
2 4 25	/10	42. Sunival MJL, The Directions, L Dain, 2024;25(2):575, 87
26	/1/	$\frac{1}{2} = \frac{1}{2} = \frac{1}$
27	718	43. Woo K Y. Meeting the challenges of wound-associated pain: anticipatory pain,
28	719	anxiety, stress, and wound healing. Ostomy Wound Manage. 2008;54(9):10-2.
29	720	44. Feeney SL. The relationship between pain and negative affect in older adults:
30	721	anxiety as a predictor of pain. J Anxiety Disord. 2004;18(6):733-44.
31	722	45. Campbell-Yeo M, Eriksson M, Benoit B. Assessment and Management of
32	723	Pain in Preterm Infants: A Practice Update. Children (Basel). 2022;9(2).
33	724	46. Teh JJ, Pascoe DJ, Hafeji S, Parchure R, Koczoski A, Rimmer MP, et al.
34	725	Efficacy of virtual reality for pain relief in medical procedures: a systematic review
35	726	and meta-analysis BMC Med 2024.22(1).64
36 27	727	47 Bechert K Abraham SE Pain management and wound care J Am Col Certif
3/ 20	728	Wound Spec 2009:1(2):65-71
20 20	720	18 Downie F. Allaway R. Preventing Medical Adhesive Related Skin Injury
40	729	(MADSI): introducing a skineare regimen for good practice. Wounds, 2024;20(1):29
41	/30	(MARSI). Infoducing a skineare regiment for good practice. wounds. 2024,20(1).56.
42	731	49. White R. A multinational survey of the assessment of pain when removing
43	732	dressings. Wounds uK. 2008;4(1):14.
44	733	50. Mbithi F, Worsley PR. Adhesives for medical application - Peel strength
45	734	testing and evaluation of biophysical skin response. J Mech Behav Biomed Mater.
46	735	2023;148:106168.
47	736	51. Holloway I, Galvin K. Qualitative research in nursing and healthcare: John
48	737	Wiley & Sons; 2017.
49	738	52. Whitley GA, Munro S, Hemingway P, Law GR, Siriwardena AN, Cooke D, et
50	739	al. Mixed methods in pre-hospital research: understanding complex clinical problems.
51	740	Br Paramed J. 2020:5(3):44-51.
52 52	741	53 Shubayev VI Kato K Myers RR Frontiers in Neuroscience
55 51	742	Cytokines in Pain In: Kruger I Light AR editors Translational Pain Research: From
55 55	7/2	Mouse to Man Boca Raton (FL): CRC Press/Taylor & Francis
56	743	$Converse to 191an. Doea Ration (FD). CRC 11055/14y101 & FlattersConverse to 2010 by Taylor and Francis Crown, LLC \cdot 2010$
57	/44	Copyright \odot 2010 by Taylor and Flancis Gloup, LLC., 2010.
58	/45	54. Su L, Jia Y, Fu L, Guo K, Ale S. The emerging progress on wound dressings
59	746	and their application in clinic wound management. Heliyon. 2023;9(12):e22520.
60		

Enseignement Superieur (ABES) Protected by copyright, including for uses related to text and data mining, AI training, and similar technologies

Patients' experiences with the application of medical adhesives to the skin

Figure legend

Figure 1: PRISMA flowchart

to oper teries only



Ovid MEDLINE(R) and Epub Ahead of Print, In-Process, In-Data-Review & Other Non-Indexed Citations, Daily and Versions 1946 to March 13, 2024

Updated search date 2024-03-13 (initial search was made in March 2022-11-10)

Sea	rchterms		Results
Pai	n		
	1	Pain/ or Acute Pain/ or Pain, Procedural/ or Pain Measurement/ or Pain Management/ or Pain Threshold/	
	2	(pain* or ache* or aching or distress* or suffer* or itch* or	
		discomfort* or anxious or anguished or agony or agonising or anxiety).ab,kf,ti.	
	3	1 or 2	
Rer	noval of c	dressings	
	4	Bandages/ or Bandages, Hydrocolloid/ or Occlusive Dressings/ or Adhesives/	
	5	Device Removal/	
	6	(remov* or redress* or chang* or select* or application* or cho?s* or apply* or "device deficienc*" or "adverse event*").ab,kf,ti.	
	7	5 or 6	
	8	4 and 7	
	9	((fastener* or adhesive* or tape* or taping or bandaid* or bandag* or dressing* or mucilage* or "sticky past*" or gum or latex or adherent* or adhering or seal*) adj4 (remov* or redress* or chang* or select* or application* or cho?s* or apply* or "device deficienc*" or "adverse event*")).ab,kf,ti.	
Cor	mbined Se	ets	
	10	8 or 9	
	11	3 and 10	3,586
	12	limit 11 to (yr="2012-01-01 -2024-03-13" and (danish or dutch or english or norwegian or swedish))	1,988

EMBASE	E via Elsevier		
Updated	d search date 2024-03-13 (initial sea	rch was made in March	2022-11-10)

earchtern	ns	Results
Pain		
1	'pain'/de OR 'pain measurement'/exp OR 'procedural pain'/de OR 'analgesia'/de	
2	pain*:ti,ab,kw OR ache*:ti,ab,kw OR aching:ti,ab,kw OR distress*:ti,ab,kw OR suffer*:ti,ab,kw OR itch*:ti,ab,kw OR discomfort*:ti,ab,kw OR anxious:ti,ab,kw OR anguished:ti,ab,kw OR agony:ti,ab,kw OR agonising:ti,ab,kw OR anxiety:ti,ab,kw	
3	#1 or # 2	
Removal o	f dressings	
4	'bandages and dressings'/de OR 'adhesive tape'/exp OR 'adhesive bandage'/de OR 'crepe bandage'/de OR 'elastic adhesive bandage'/de OR 'tubular bandage'/de OR 'central line dressing'/de OR 'surgical tape'/de OR 'hydrocolloid dressing'/de OR 'occlusive dressing'/de OR 'adhesive agent'/de OR 'sealant'/de	
5	'device removal'/de	
6	remov*:ti,ab,kw OR redress*:ti,ab,kw OR chang*:ti,ab,kw OR select*:ti,ab,kw OR application*:ti,ab,kw OR cho\$s*:ti,ab,kw OR apply*:ti,ab,kw OR 'device deficienc*':ti,ab,kw OR 'adverse event*':ti,ab,kw	
7	#5 or #6	
8	#4 and #7	
9	(fastener* OR adhesive* OR tape* OR taping OR bandaid* OR bandag* OR dressing* OR mucilage* OR 'sticky past*' OR gum OR latex OR adherent* OR adhering OR seal*) NEAR/4 (remov* OR redress* OR chang* OR select* OR application* OR cho\$s* OR apply* OR 'device deficienc*' OR 'adverse event*')	
10	#8 or #9	
Combined	Sets	•
11	#3 and #10	5,298
12	#11 NOT 'conference abstract'/it AND ([danish]/lim OR [dutch]/lim OR [english]/lim OR [norwegian]/lim OR [swedish]/lim) AND [2012-01-01-2024-03-13]/py	2,160

PsycINFO via EBSCO

Updated search date 2024-03-13 (initial search was made in March 2022-11-10)

Sea	rchterms		Results
Paiı	n		
	S1	DE "Pain" OR DE "Acute Pain" OR DE "Pain Management" OR DE "Pain	
		Measurement" OR DE "Suffering"	
	S2	TI (pain* or ache* or aching or distress* or suffer* or itch* or	
		discomfort* or anxious or anguished or agony or agonising or anxiety)	
		OR AB (pain* or ache* or aching or distress* or suffer* or itch* or	
		discomfort* or anxious or anguished or agony or agonising or anxiety)	
	S3	S1 OR S2	
Rer	noval of d	ressings	
	S4	TI ((fastener* or adhesive* or tape* or taping or bandaid* or bandage* or bandaging or dressing* or mucilage* or "sticky past*" or gum or latex or adherent* or adhering or seal*) N3 (remov* or redress* or chang* or selection* or application* or cho#s* or apply* or "device deficienc*" or "adverse event*")) OR AB ((fastener* or adhesive* or tape* or taping or bandaid* or bandage* or bandaging or dressing* or mucilage* or "sticky past*" or gum or latex or adherent* or adhering or seal*) N3 (remov* or redress* or chang* or selection* or application* or cho#s* or apply* or "device deficienc*" or "adverse event*"))	
Cor	mbined S	ets	
	S5	S3 AND S4	131
	S6	S5 Limiters - Published Date: 2012-01-01-2024-03-13; Language: Danish, Dutch, English, Norwegian, Swedish	69

CINAHL via EBSCO
Updated search date 2024-03-13 (initial search was made in March 2022-11-10)

earchterm	S	Results
ain		
S1	(MH "Pain") OR (MH "Pain, Procedural") OR (MH "Pain Management")	
	OR (MH "Pain Measurement")	
S2	TI (pain* or ache* or aching or distress* or suffer* or itch* or	
	discomfort* or anxious or anguished or agony or agonising or anxiety)	
	OR AB (pain* or ache* or aching or distress* or suffer* or itch* or	
	discomfort* or anxious or anguished or agony or agonising or anxiety)	
S3	S1 OR S2	
emoval of	dressings	
S4	(MH "Bandages and Dressings+") OR (MH "Tapes") OR (MH	
	"Transparent Dressings") OR (MH "Adhesives")	
S5	TI (remov* or redress* or chang* or select* or application* or cho?s*	
	or apply* or "device deficienc*" or "adverse event*") OR AB (remov*	
	or redress* or chang* or select* or application* or cho?s* or apply* or	
	"device deficienc*" or "adverse event*")	
S6	S4 AND S5	
S7	TI (((fastener* or adhesive* or tape* or taping or bandaid* or bandag*	
	or dressing* or mucilage* or "sticky past*" or gum or latex or	
	adherent* or adhering OR seal*) N3 (remov* or redress* or chang* or	
	select* or application* or cho#s* or apply* or "device deficienc*" or	
	"adverse event*"))) OR AB (((fastener* or adhesive* or tape* or taping	
	or bandaid* or bandag* or dressing* or mucilage* or "sticky past*" or	
	gum or latex or adherent* or adhering or seal*) N3 (remov* or redress*	
	or chang* or select* or application* or cho#s* or apply* or "device	
	deficienc*" or "adverse event*")))	
S8	S6 OR S7	
ombined	Sets	
S9	S3 AND S8	2,004
S10	S9 Limiters - Published Date: 2012-01-01-2024-03-13; Language:	1,246
	Danish, Dutch/Flemish, English, Norwegian, Swedish	,

BMJ Open

Supplementary Table: Assessment of Methodological Quality (JBI Critical Appraisal Tool: Checklist for Qualitative Research).

	Bateman	Docking	Elliott &	Furness	Grocott	Probet	Roma	Unver	Wang
	(2015)	et al. (2018)	Bluebelle Study Group (2017)	et al. (2019)	et al. (2013)	et al. (2023)	et al. (2021)	et al. (2018)	et al. (2015
1. Is there congruity between the stated philosophical perspective and the research methodology?	NA	N	U	U	Y	Y	U	Y	Y
2. Is there congruity between the research methodology and the research question or objectives?	U	Y	Y	Y	Y	Y	Y	Y	Y
3. Is there congruity between the research methodology and the methods used to collect data?	Y	Y	Y	Y	Y	Y	Y	Y	Y
4. Is there congruity between the research methodology and the representation and analysis of data?	U	Y	Y	Y	Y	Y	Y	Y	Y
5. Is there congruity between the research methodology and the interpretation of results?	Y	Y	Y	Y	Y	Y	Y	Y	Y
6. Is there a statement locating the researcher culturally or theoretically?	N	N	N	Ν	Ν	N	Ν	U	U
7. Is the influence of the researcher on the research, and vice versa, addressed?	N	N	N	N	Ν	Y	Ν	N	N
8. Are participants, and their voices, adequately represented?	Y	Y	Y	Y	Y	Y	Y	Y	Y
9. Is the research ethical according to current criteria or, for recent studies, and is there evidence of ethical approval by an appropriate body?	N	Y	Y	Y	Y	Y	U	Y	Y
10. Do the conclusions drawn in the research report flow from the analysis, or interpretation, of the data?	Y	Y	U	Y	Y	Y	Y	Y	Y

Y = Yes; N = No; U = Unclear; NA = Not Applicable