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Prevention and Management of Incontinence-Associated Dermatitis in the Pediatric Population

An Integrative Review

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ABSTRACT

An integrative review was conducted to synthesize evidence on prevention and management of incontinence-associated dermatitis (IAD) in the pediatric population. A 5-step integrative process was used to guide the review. Articles published from January 2000 to April 6, 2017, were identified and retrieved from CINAHL, PubMed, ProQuest (MEDLINE), and Scopus; key terms were associated with IAD, pediatric, prevention, and management. Supplemental and manual searches were carried out to identify other relevant studies. The studies' findings were extracted and summarized in a table of evidence, with their quality evaluated using the Joanna Briggs Institute's Critical Appraisal Checklist. Sixteen articles were included in the review. Articles explored prevention and management strategies including skin cleansing technique, diaper selection, and the application of topical skin care products. Inconsistent and limited evidence was found regarding the benefits of using disposable wipes in preference to water-moistened washcloths in the cleansing process and on the use of superabsorbent polymer diapers with breathable outer lining in IAD prevention. Findings were inconclusive with regard to the best topical skin care product for IAD care. However, the application of skin protectants was encouraged by the authors, as well as promoted in various clinical guidelines. The development of a structured skin care regimen supplemented by a comprehensive patient education program was advised to enhance the prevention and management of IAD.

KEY WORDS: Children, Diaper dermatitis, Diaper rash, Incontinence-associated dermatitis, Infant, Management, Pediatric, Prevention.

INTRODUCTION

Incontinence-associated dermatitis (IAD) is one of the conditions described under the constellation of moisture-associated skin damage.[1] It is characterized by inflamed, erythematous, and occasionally eroded skin due to excessive exposure to urine, stool, or both.[2] The skin is the largest organ in the human body and functions as the main deterrent to irritants and pathogens.[3] Its primary protective and barrier properties are conferred by the outermost epidermal layer, the stratum corneum.[4] A damaged stratum corneum is more permeable to irritants, triggering the inflammatory process clinicians label dermatitis.[5,6]

Infants and children who have not undergone potty training, and older pediatric patients with urinary or fecal incontinence who are subjected to ongoing contact with urine or stool of the skin underneath a diaper or absorbent product, are at risk for damage to the skin's epithelial barrier (stratum corenum).[4,7,8] Apart from the damage caused by overhydration, changes in cutaneous pH also impair the barrier properties of the stratum corneum.[6] A pH of 4 to 6 is crucial for maintaining the skin's acid mantle that enhances cohesion within the stratum corneum and impedes colonization by potentially pathogenic microorganisms.[9] However, both urinary and fecal matters contain ammonia, which has a pH of 11.6 in its pure form. Prolonged exposure to ammonia can increase the skin pH.[9,10] Fecal materials also contain digestive enzymes such as lipases and proteases that are activated at more alkaline pH ranges, causing further damage to the stratum corneum.[6] Studies have been conducted to establish if skin contact with either urine or stool is of greater influence in predisposing the individual to risk of IAD development, but results are inconclusive.[11,12] Nevertheless, clinical experience strongly suggests that that dual urinary and fecal incontinence or liquid stool is more damaging than urinary incontinence alone or incontinence of solid stool. This effect may be attributable to the higher pH range existing with these forms of incontinence, along with the higher concentration of fecal enzymes in liquid fecal materials such as active proteases and lipases, thus maximizing inflammation and damage to the stratum corneum.[1,6,11,13]

The prevalence of IAD in the pediatric population is not known.[14] Diaper dermatitis is often used as a nonspecific term to describe a wider range of inflammatory, eroded, or ulcerated skin lesions that manifest in the diapered skin.[14-16] The etiology of diaper dermatitis has been attributed to irritant contact dermatitis, psoriasis, fungal infections, nutritional deficiency, and immunodeficiency syndromes.[14,16,17] Research suggest that diaper dermatitis contributes to 1 in 5 pediatric dermatology visits and that IAD specifically is the commonest presentation.[14,18,19] A study of skin integrity of children after admission at a children's hospital in the United States

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reported a 10-fold higher IAD prevalence rate compared to pressure injuries.[20] In the United Kingdom, an IAD prevalence rate of 16% was reported in the pediatric department of a large district general hospital.[21] Li and colleagues[22] evaluated 5 maternity and child health facilities in China and reported that at least 2 in 5 children experienced at least 1 episode of IAD during the 6 weeks preceding data collection.

Even though IAD is not a life-threatening condition, it causes unnecessary discomfort, pain, pruritus, and paresthesia in patients, which affect health-related quality of life, in addition to being costly and difficult to treat.[1,6] It also puts individuals at risk of developing secondary infections and is potentially dangerous to patients who are immunocompromised.[23,24] The overhydrated skin cells have a reduced endurance to pressure and friction, increasing the risk of developing pressure injuries.[1] Additionally, restoration of skin barrier function in visibly healed IAD was found to be suboptimal on measurements of factors such as water flux and barrier integrity, indicating patients' susceptibility to recurrent IAD.[15] Experts have advocated that prevention is the best management for IAD.[1,6,25] However, a lack of robust clinical trials that are eclipsed by a vast range of skin care products has hindered clinicians' abilities to identify the best interventions to prevent and manage IAD.[25-27] Moreover, there is a limited international consensus regarding the prevention and treatment in younger patients. This integrative review seeks to address this knowledge gap through synthesizing current best evidence within this domain.

METHODS

A 5-step integrative process was used to guide the review; they are (1) problem identification, (2) literature search, (3) data evaluation, (4) data synthesis, and (5) presentation of findings.[28] The problem statement was: "What are current evidence-based practices for prevention and management of IAD in the pediatric population?" Inclusion criteria were research-based studies published in the English language from the year 2000 to April 6, 2017, involving pediatric patients and interventions to prevent or manage IAD. Studies that recruited subjects with preexisting skin disease such as eczema and psoriasis as well as studies looking at treatment of infectious dermatitis conditions such as candidal dermatitis were excluded. Four electronic databases, CINAHL, PubMed, ProQuest (MEDLINE), and Scopus, were searched using key terms related to these concepts (Table 1). Boolean operators and truncation were used to refine the search and identify most relevant articles. Limiters were set as "article published after 1st January 2000 till present" and "in English Language." Supplementary searches were carried out in the *Journal of Wound Ostomy Continence Nursing* and *Pediatric Dermatology Journal*. A manual search was also conducted and examined the reference lists of the eligible articles for further possible inclusions. The suitable studies were evaluated by the author using the Joanna Briggs Institute Critical Appraisal Checklist.[29] Study findings were extracted and summarized in a table of evidence for comparison and analysis.

TABLE 1.
Key Search Terms

Key Words	Key Search Terms
Pediatric	Pediatric, children, baby, neonate, infant, toddler
Incontinence-associated dermatitis	IAD, diaper dermatitis, diaper rash, nappy dermatitis, nappy rash, moisture-associated skin damage, moisture lesion
Prevention and management	Prevention, management, treatment, intervention

RESULTS

Seven hundred fifty-nine articles were retrieved from the 4 databases. After the removal of duplicates and the exclusion of articles that lack relevance to the focus of this integrative review, 22 articles remained. The remaining 22 articles were further assessed for eligibility, resulting in the exclusion of another 6 articles. Five of the excluded articles were reported in a previous literature review that is included in this study. The sixth article was a Cochrane review[30] that contained a single study meeting inclusion criteria for this review. This study was also included in a more recent literature review,[25] which was selected for this integrative review. No articles were found in the *Journal of Wound, Ostomy and Continence Nursing* and *Pediatric Dermatology Journal* that were not identified in our search of the electronic databases. Three other potential articles were found after examining the reference lists of the 16 eligible articles. However, 2 of them were reported in Chinese language (Mandarin) and 1 was written in the German language and therefore could not be included in this review. The literature search result was summarized using a PRISMA flow diagram adopted from Moher and colleagues and The PRISMA Group[31] (Figure).

Five articles, 3 randomized controlled trials (RCTs) and 2 systematic reviews, reported on strategies to prevent IAD, and the remaining 11 elements comprised 10 RCTs and 1 systematic review that evaluated interventions for managing IAD. The systematic review conducted by Rowe and colleagues[32] aimed to gather evidence to identify barrier preparations that were effective in the prevention and management of IAD but did not include any IAD prevention-related articles and therefore this review was classified as an IAD management-related

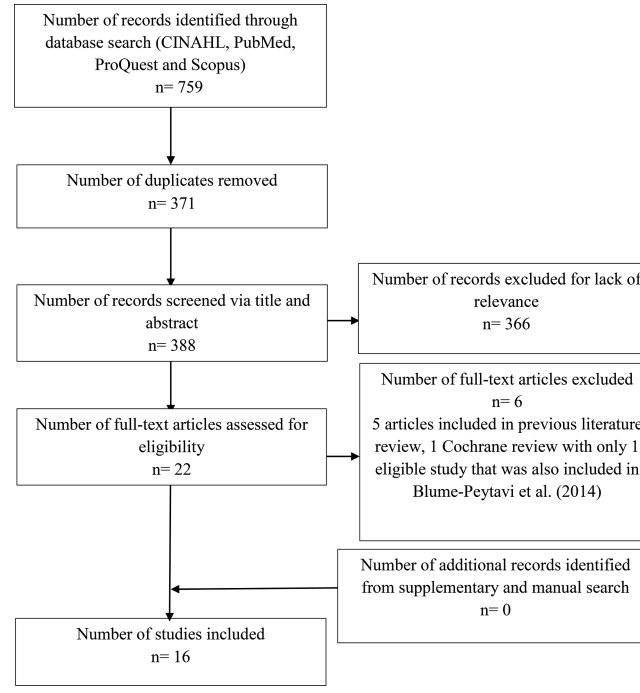

Figure. The PRISMA flow diagram outlines the literature search.

study. The characteristic of the included studies are summarized in Table 2 and the results are presented in Table 3.

DISCUSSION

Incontinence-associated dermatitis can affect individuals of all ages, who require the use of containment devices for the management of incontinence, or in the case of infants and children prior to toileting training for urinary and fecal output.[2] In the pediatric population, such devices, primarily diapers, are used until they acquire the cognitive ability to maintain continence (ie, complete toilet or potty training).[33] Furthermore, children with certain neurological conditions such as spina bifida, cerebral palsy, paraplegia, and other sensory or cerebrospinal defects who experience incontinence require long-term containment of urine and stool. Parents with diapered children reported IAD as their top dermatological concern.[14,18] However, most strategies currently employed by parents and caregivers for prevention and management of IAD tend to be based on popular opinion and anecdote rather than firm evidence.[34,35] In the clinical setting, the lack of a standardized assessment tool and an intervention protocol also hinders the management of IAD.[36]

The assessment and diagnosis of IAD depend mainly on inspection and related observations. Nevertheless, the various assessment tools used by researchers lacked rigorous validation.[34,37] Additional research establishing the validity and reliability of IAD assessment tools is needed. For example, a well-designed IAD assessment tool to enhance the ability of clinicians in differentiating IAD lesions from other forms of skin damage is needed to augment our ability to provide appropriate care and monitor outcomes.[6,36]

Incontinence-associated dermatitis management should also aim to prevent further skin damage.[1,6,38] It is important to minimize irritant contact in at-risk patients and preserve their skin integrity and barrier function. Preventive and management strategies such as appropriate selection of the type of containment device used, skin cleansing techniques, and the application of topical barrier products can help either deter or hasten the development of IAD and aid in healing. The findings from this review indicate a lack of consensus for a consistent and

TABLE 2.
Characteristics of the Included Studies

Author (Year)/Country	Study Design	Duration of Study	Sample Size	Participants Characteristic	Outcome Measured		
					Presence/ Improvement of IAD (Yes/No)	Skin Erythema Scale	Skin Function Parameter
IAD prevention-related studies							
Visscher[46] (2009)/USA	Single-center, investigator-blinded RCT	14 d	130	Age 30-51 wk old		X	X
Alonso et al[62] (2013)/Spain	Single-center, investigator-blinded RCT	21 d	229	Neonates		X	
Bartels et al[63] (2014)/ Germany	Single-center, investigator-blinded RCT	8 wk	89	Age 9 mo old	X		X
Baer et al[45] (2006)/Australia	Cochrane systematic review	Search period: 1960-2004	9 articles	Birth to 2 y old	X	X	
Blume-Peytavi et al[25] (2014)/ Germany	Systematic review	Search period: 1970-2012	13 articles	Birth to 2 y old	X	X	X
IAD management-related studies							
Wananukul et al[64] (2006)/ Thailand	Multicenter, double-blinded RCT	7 d	46	Birth to 2 y old		X	X
Panahi et al[65] (2012)/Iran	Single-center, double-blinded RCT	10 d	66	Less than 3 y old		X	
Farahani et al[59] (2013)/Iran	Single-center, investigator-blinded RCT	7 d	141	Birth to 2 y old		X	
Adib-Hajbaghery et al[66] (2014a)/Iran	Multicenter, double-blinded RCT	7 d	60	Age 1-24 mo	X		
Adib-Hajbaghery et al[67] (2014b)/Iran	Multicenter, double-blinded RCT	7 d	60	Age 1-24 mo	X		
Gozen et al[68] (2014)/Turkey	Single-center RCT	5 d	63	Newborn		X	
Mahmoudi et al[69] (2015)/Iran	Multicenter, double-blinded RCT	3 d	10	Age 1-24 mo		X	
Keshavarz et al[70] (2016)/Iran	Single-center, triple-blinded RCT	5 d	82	Birth to 2 y old		X	
Nourbakhsh et al[71] (2016)/ Iran	Single-center, double-blinded RCT	Till recovery	64	Birth to 2 y old	X		
Qiao et al[72] (2016)/China	Single-center RCT	Till recovery	210	Infants		X	
Rowe et al[32] (2008)/ New Zealand	Systematic review	Search period: 1980-2005	5 articles	Less than 5 y old	X	X	

Abbreviations: IAD, incontinence-associated dermatitis; RCT, randomized controlled trial.

TABLE 3.
Integrative Review Results

Author (Year)/Country	Intervention A	Intervention B	Control	Findings/Results
IAD prevention-related studies (containment device)				
Baer et al[45] (2006)/Australia		NA		Conflicting evidence in the use of various types of diapers. - Disposable diapers: One article found lower mean IAD score, another found no difference when compared with cloth diapers - Superabsorbent polymer: 2 articles supported usage, 2 articles found no significant difference Diapers with breathable outer lining and inner lining impregnated with petrolatum/zinc oxide have potential benefits in reducing the incidence of IAD
IAD prevention-related studies (skin cleansing techniques)				
Visscher[49] (2009)/USA	Wipe A (pH 5.2)	Wipe B (pH 4.0)	Water-moistened washcloths	Intervention A and B vs control - Mean skin erythema lower ($P < .005$) - TEWL lower ($P = .002$) Skin pH lowest in intervention B ($P \leq .002$)
Bartels et al[63] (2014)/ Germany	Water-moistened washcloth + diaper cream (zinc oxide)	Wet wipes + diaper cream (zinc oxide)	Water-moistened washcloths	Comparing baseline and at week 8: Intervention A - TEWL decreased ($P = .007$) - Skin pH increased ($P < .007$) Intervention B - TEWL stable - Skin pH increased ($P < .007$) 8 IAD patients detected (no information provided regarding which arm participants were from)
Blume-Peytavi et al[25] (2014)/Germany		NA		- Skin erythema: Lower mean score (2 articles) vs no difference with water-moistened washcloths (2 articles) - TEWL: Lower (1 article) vs no difference with water-moistened washcloth (3 articles) - Skin pH: Smaller rise as compared to water-moistened washcloths; more acidic wipes resulted in a lower skin pH
IAD prevention-related studies (topical skin care products)				
Alonso et al[62] (2013)/Spain	Petrolatum jelly	NA	No cream	Incidence of IAD: - 17.1% vs 22.2% ($P = .39$)
Bartels et al[63] (2014)/ Germany	Water-moistened washcloths + diaper cream (zinc oxide)	Wet wipes + diaper cream (zinc oxide)	Water-moistened washcloth	Comparing baseline and at week 8: Intervention A - TEWL decreased ($P = .007$) - Skin pH increased ($P < .007$) Control - TEWL stable - Skin pH stable 8 IAD patients detected (no information provided regarding which arm participants were from)
Blume-Peytavi et al[25] (2014)/Germany		NA		- No evidence supporting the benefit of using vitamin A or primrose oil - Usage of baby cream twice weekly did not influence the incidence of IAD
IAD management-related studies (topical skin care products)				
Panahi et al[65] (2012)/Iran	*Calendula officinalis* cream	Aloe vera cream	NA	Severity of IAD: - Reduced in both groups ($P < .001$) - Improvement greater in the *Calendula* arm ($P = .001$)
Adib-Hajbaghery et al[66] (2014a)/Iran	*Calendula officinalis* cream	Bentonite 50% cream	NA	Improvement at 6 h: - 40% vs 93.3% ($P < .001$) Complete healing at day 3: - 36.7% vs 90% ($P < .001$)

(*continues*)

TABLE 3.
Integrative Review Results (*Continued*)

Author (Year)/Country	Intervention A	Intervention B	Control	Findings/Results
Adib-Hajbaghery et al[67] (2014b)/Iran	*Calendula officinalis* cream	Bentonite 50% cream	NA	Improvement at 6 h: - 40% vs 93.3% ($P < .001$) Complete healing at day 3: - Risk ratio of 5.21 in the bentonite arm compared to the *Calendula* arm (CI, 1.78-15.2)
Mahmoudi et al[69] (2015)/ Iran	*Calendula officinalis* cream	Bentonite 50% cream	NA	Improvement at 6 h: - 56% vs 80% ($P < .001$) Complete healing at day 3: - 52% vs 86% ($P < .001$)
Nourbakhsh et al[71] (2016)/ Iran	*Calendula officinalis* cream	Magnesium + *Calendula*	NA	Duration of recovery: - 3.25 ± 0.67 d vs 1.5 ± 0.5 d ($P < .001$)
Wananukul et al[64] (2006)/ Thailand	5% zinc oxide and 5% dexpanthenol ointment	Liquid paraffin and bee wax ointment	NA	Both arms' baseline vs end of treatment: - IAD severity reduced ($P < .0001$) - TEWL reduced ($P < .001$) No significant difference in both arms (severity score: $P = .16$; TEWL: $P = .07$)
Gozen et al[68] (2014)/Turkey	Barrier cream (40% zinc oxide)	Human breast milk	NA	Severity score reduction at day 5: - 93.6% vs 60% ($P = .002$) Duration of recovery: - 3.5 ± 1.17 d vs 3.82 ± 1.1 ($P = .294$)
Qiao et al[72] (2016)/China	Zinc oxide plaster and routine care	Mupirocin plaster, topical application of pearl powder, and routine care	NA	After 1 cycle: - All groups improved ($P < .05$) - Intervention A had the slowest healing rate, followed by interventions B and C. Duration of recovery: - Intervention A slowest (107.53 ± 21.43 h), followed by intervention B (86.81 ± 18.43 h) and C (71.64 ± 16.72 h) ($P < .05$)
Rowe et al[32] (2008)/ New Zealand		NA		Application of zinc oxide or petrolatum-based product as compared to no treatment is more effective in the reduction of IAD Zinc oxide: - Does have a certain degree of benefits but with limited supporting literature - Less effective than oxyquinoline, eosin, and miconazole nitrate 0.25% (especially for alleviating more severe and persistent forms of IAD)
Farahani et al[59] (2013)/Iran	1% hydrocortisone ointment	Human breast milk	NA	- Both arms' IAD severity score improved from baseline ($P < .001$) - No significant differences in the improvement rate
Keshavarz et al[70] (2016)/Iran	1% hydrocortisone cream	Henna oil	NA	- Both arms' mean IAD scores improved ($P < .001$). - Day 3: No difference found in the IAD severity ($P > .05$) - Day 5: The henna oil arm showed a better rate of improvement ($P = .042$)

Abbreviations: IAD, incontinence-associated dermatitis; NA, not applicable; TEWL, transepidermal water loss.

effective solution for prevention and management of IAD. Previous literature reviews[25,26,32,39] performed in both the adult and pediatric settings reported similar constraints. Nevertheless, similar to the recommendations by other authors,[6,11,40] the review has highlighted the benefits of having an evidence-based structured skin care regimen for promoting healthy skin care habits and minimizing the development of IAD.

Absorbent Devices: Diaper Selection

The findings from the review were limited and inadequate to support or refute the use of disposable diapers over cloth diapers. Nevertheless, evidence was inclined towards diapers with a higher absorbent capacity and a breathable outer lining. Expert opinion and research-based evidence support the use of diapers containing superabsorbent polymers for prevention and management of IAD.[15,21,38,41-43] Superabsorbent polymers aid in the rapid absorption and containment of fluids,[42] thus reducing skin wetting and irritant skin contact. Furthermore, the breathable outer lining incorporated into some disposable diapers promotes vapor exchange, and dryness in the microenvironment between absorbent product and skin, thus minimizing overhydration of skin cells.[42] In one study, 7 of 10 children using cloth diapers were found to have IAD in the perianal and intertriginous regions,[41] further highlighting the

importance of using diapers with a higher absorbent capacity. Moreover, neonates and infants using cloth diapers were found to have a higher risk of acquiring neonatal sepsis when compared to those using disposable diapers.[44] The use of diapers impregnated with a skin protectant was also found to reduce IAD severity,[15,45,46] although the cost of these diapers may restrict their use.

In addition, we found several clinical guidelines that recommended diaper-free periods to prevent and aid wound healing in those who have developed IAD.[8,19,33] However, we did not find any studies that examined the benefits of diaper-free periods in managing IAD. While the diapered area was described as more hydrated that the nondiapered area (regardless of the extent of soiling), the optimal diaper-free duration is unknown and varies considerably depending on caregiver preference.[34,35,47,48]

Skin Cleansing Techniques

The use of disposable wipes for cleansing diapered skin was controversial. Preservatives in the wipes were proposed to cause skin irritation, but several manufacturers have attempted to minimize the type and number of preservative additives used.[49,50] In the Ehretsmann and colleagues[51] study, disposable wipes were found to be safe even for infants with atopic dermatitis. Even though there was a lack of consistency in the evidence reported from the reviewed articles, disposable wipes appeared to be able to maintain skin integrity to a level that was at least equivalent if not superior to water-moistened washcloths. The use of water-moistened washcloths or cotton products required more forceful scrubbing to remove contaminants, as water alone was reported to be inadequate in the removal of fat-soluble waste products.[52] Conversely, most disposable wipes contain fat-soluble solvents that could aid in the removal of waste products.[46]

The influence of skin cleansers on cutaneous pH is important for maintenance of the integrity and cohesion of the stratum corneum and preservation of the skin's normal flora.[11] Water has a pH of 7 and is neutral as compared to normal skin pH, which ranges from 4 to 6.[53] Nevertheless, due to the immature and delicate skin of neonates and infants, disposable wipes used in the pediatric population should be selected with caution. A soft, nonwoven, nonfragrant, alcohol-free, pH-balanced wipe is preferred.[11,25,54] In addition, a gentle cleansing technique that minimizes scrubbing is recommended.[5,14,36] We did not find any studies that compared the effect of disposable wipes and water-moistened washcloths or cotton on damaged skin. No studies were found that explored the feasibility of using no-rinse skin cleansers in the pediatric population. In the adult setting, however, a no-rinse skin cleanser is highly recommended for use in lieu of soap and water or water alone.[6] No-rinse cleansers have the benefits of being quick drying, which prevents unnecessary friction during drying of skin, are usually pH-neutral, and are able to remove contaminants more effectively than water alone.

Topical (Leave-on) Skin Care Products

Topical or leave-on skin care products minimize skin contact with chemical irritants, urine, and fecal material or help maintain and restore the skin barrier.[6,11] The majority of the reviewed articles assessed the efficacy of topical skin care products in the prevention and management of IAD, but no conclusions could be drawn to recommend the most effective product. Experts and guidelines recommend the application of skin protectants containing active ingredients such as zinc oxide, petrolatum, and dimethicone after the cleansing of the perineum to protect high-risk patients from IAD.[36,38,39] Nevertheless, the benefits of zinc oxide and petrolatum were not conclusively demonstrated in this review. In a literature review conducted in the adult setting, the efficacy of dimethicone-based no-sting barrier films was found to be comparable to zinc oxide- and petrolatum-based creams and they were also reported to be more cost-effective when used in IAD prophylaxis.[55] However, there was a lack of data surrounding the efficacy of dimethicone in the pediatric population. Additionally, it was not clear whether the concentration of the active ingredients played a major role in the effectiveness of the skin protectants. This further increases the challenge of selecting a cost-effective, evidence-based product.

As the development of IAD is driven by an underlying inflammatory process, the use of products containing anti-inflammatory properties was favored among clinicians managing IAD. Topical steroidal products such as hydrocortisone are frequently prescribed for its anti-inflammatory effects on various dermatoses such as IAD.[56] However, beyond the common side effects of steroid creams (cutaneous irritation and steroid atrophy), we identified a few case studies that reported the development of iatrogenic Cushing syndrome in children after prolonged and inappropriate usage of these creams in the diapered area.[57,58] Breast milk may be as effective as hydrocortisone cream in reducing the severity of IAD, with no known reported side effects and may be a preferable option.[59] However, breast milk does not possess the barrier function capability that other skin protectants confer, and it may not be readily available to all caregivers. We also identified a natural product commonly used in Iran (*Calendula officinalis* cream; Pharmaceutical, Hygienic and Food Industries, Dineh, Iran) with purported anti-inflammatory and antimicrobial effects. However, its benefits were not proven over conventional creams such as bentonite.

While the evidence surrounding the use of topical skin care products was limited and inconclusive, it is evident that the application of such products does help minimize the development of IAD and aid in skin recovery. The application of a thick layer of skin protectants was consistently advocated in clinical guidelines, and care providers were cautioned against total removal of leave-on skin products at every diaper change.[14,36,38] Dabbing motions to remove soiled cream and topping up of the protectant as necessary were proposed, as these reduce unnecessary epidermal stripping.

Structured Skin Care Regimen

The authors of all the articles we reviewed also discussed the benefits of a structured skin care regimen and the importance of caregivers' education in the prevention and management of IAD. A structured skin care regimen comprising proper assessment, cleansing, and protection was recommended in multiple clinical guidelines.[6,24,36,38,60,61] Because most IAD cases occur in the community, and more than half of them are managed without advice from a health care professional,[14,21] providing IAD prevention and management education to caregivers of children of diapering age will be beneficial in reducing the occurrence of IAD.[34]

CONCLUSION

Incontinence-associated dermatitis is a prevalent and problematic condition of childhood that worsens health outcomes

and causes distressing discomfort. Although multiple management and prevention strategies were identified in the review, we found a paucity of evidence-based and comprehensive research within this field. The 2 most consistent findings suggest the use of high absorbency, breathable diapers, as well as additive-free disposable cleanser wipes, with the caveat that the evidence for supporting their use remains conditional at best. Health care institutions should establish structured skin care regimens and patient and caregiver education programs. Further research is needed to enable clinicians to offer patients the best, most effective, and evidence-based care.

REFERENCES

1. Black JM, Gray M, Bliss DZ, et al. MASD, part 2: incontinence-associated dermatitis and intertriginous dermatitis: a consensus. *J Wound Ostomy Continence Nurs*. 2011;38(4):359-370.
2. Gray M, Bliss DZ, Doughty DB, Ermer-Seltun J, Kennedy-Evans KL, Palmar MH. Incontinence-associated dermatitis: a review. *J Wound Ostomy Continence Nurs*. 2007;34(1):45-56.
3. Bardsley A. Prevention and management of incontinence-associated dermatitis. *Nurs Stand*. 2013;27(44):41-46.
4. Voegeli D. Moisture-associated skin damage: aetiology, prevention and treatment. *Br J Nurs*. 2012;21(9):517-521.
5. Atherton DJ. The aetiology and management of irritant diaper dermatitis. *J Eur Acad Dermatol Venereol*. 2001;15:1-4.
6. Beeckman D, Campbell J, Campbell K, et al. Incontinence-associated dermatitis: moving prevention forward. http://www.woundsinternational.com/media/other-resources/_/1154/files/iad_web.pdf. Published 2015. Accessed 9 March 2017.
7. Mayrovitz HN, Sims M. Biophysical effects of water and synthetic urine on skin. *Adv Skin Wound Care*. 2001;14(6):302-308.
8. The Royal Children's Hospital Melbourne. Clinical practice guidelines: nappy rash. http://www.rch.org.au/clinicalguide/guideline_index/Nappy_rash. Accessed 12 March, 2017.
9. Ali SM, Yosipovitch G. Skin pH: from basic science to basic skin care. *Acta Derm Venereol*. 2013;93:261-267.
10. Langemo D, Hanson D, Hunter S, Thomson P, Oh IE. Incontinence and incontinence associated dermatitis. *Adv Skin Wound Care*. 2011;24(3):126-140.
11. Gray M, Beeckman D, Bliss DZ, et al. Incontinence-associated dermatitis: a comprehensive review and update. *J Wound Ostomy Continence Nurs*. 2012;39(1):61-74.
12. Junkin J, Selekof JL. Prevalence of incontinence and associated skin injury in the acute care inpatient. *J Wound Ostomy Continence Nurs*. 2007;34(3):260-269.
13. Leyden JJ, Katz S, Stewart R, Kligman AM. Urinary ammonia and ammonia-producing microorganisms in infants with and without diapers dermatitis. *Arch Dermatol Res*. 1977;113(12):1678-1680.
14. Klunk C, Domingues E, Wiss K. An update on diaper dermatitis. *Clin Dermatol*. 2014;32:477-487.
15. Visscher MO, Hoath SB. Diapers dermatitis. In: Chew AL, Maibach HI, eds. *Irritant Dermatitis*. Berlin, Germany: Springer; 2006:37-50.
16. Scheinfeld N. Diaper dermatitis: a review and brief survey of eruptions of the diaper area. *Am J Clin Dermatol*. 2005;6(5):273-281.
17. Coughlin CC, Eichenfield LF, Frieden IJ. Diaper dermatitis: clinical characteristics and differential diagnosis. *Pediatr Dermatol*. 2014;31(1):19-24.
18. Fernandes JD, Machado MCR, Oliveira ZNP. Clinical presentation and treatment of diaper dermatitis, part II. *An Bras Dermatol*. 2009;84(1):47-54.
19. Ravanfar P, Wallace JS, Pace NC. Diaper dermatitis: a review and update. *Curr Opin Pediatr*. 2012;24(4):472-479.
20. Noonan C, Quigley S, Curley MA. Skin integrity in hospitalized infants and children a prevalence survey. *J Pediatr Nurs*. 2006;21(6):445-453.
21. Adalat S, Wall D, Goodyear H. Diaper dermatitis—frequency and contributory factors in hospital attending children. *Pediatr Dermatol*. 2007;24(5):483-488.
22. Li CN, Zhu ZH, Dai YH. Diaper dermatitis: a survey of risk factors for children aged 1-24 months in China. *J Int Med Res*. 2012;40(5):1752-1760.
23. Ratliff C, Dixon M. Treatment of incontinence-associated dermatitis (diaper rash) in a neonatal unit. *J Wound Ostomy Continence Nurs*. 2007;34(2):158-162.
24. Ryan E, Hall S. The standardisation of treatment for napkin-associated dermatitis with paediatric oncology. *Wound UK*. 2016;12(1):52-58.
25. Blume-Peytavi U, Hauser M, Lunnemann L, Stamatas GN, Kottner J, Bartels NG. Prevention of diaper dermatitis in infants: a literature review. *Pediatr Dermatol*. 2014;31(4):413-429.
26. Beeckman D, Schoonhoven L, Verhaeghe S, Heyneman A, Defloor T. Prevention and treatment of incontinence-associated dermatitis: literature review. *J Adv Nurs*. 2009;65(6):1141-1154.
27. King A, Stellar JJ, Blevins A, Shah KN. Dressings and products in paediatric wound care. *Adv Wound Care*. 2013;3(4):324-334.
28. Whittemore R, Knafl K. The integrative review: updated methodology. *J Adv Nurs*. 2005;52(5):546-553.
29. The Joanna Briggs Institute. Critical appraisal tools. http://joannabriggs.org/research/critical-appraisal-tools.html. Published 2016. Accessed March 9, 2017.
30. Davies MW, Dore AJ, Perissinotto KL. Topical vitamin A or its derivatives for treating and preventing napkin dermatitis in infants. *Cochrane Database Syst Rev*. 2005;(4):CD004300.
31. Moher D, Liberati A, Tetzlaff J, Altman DG; The PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Med*. 2009;6(7):e1000097.
32. Rowe J, McCall E, Kent B. Clinical effectiveness of barrier preparations in the prevention and treatment of nappy dermatitis in infants and preschool children of nappy age. *Int J Evid Based Healthc*. 2008;6(1):3-23.
33. Stamatas GN, Tierney NK. Diaper dermatitis: etiology, manifestations, prevention, and management. *Pediatr Dermatol*. 2014;31(1):1-7.
34. Hugill K. Revisiting infant nappy dermatitis: causes and preventive care. *Br J Midwifery*. 2017;25(3):150-154.
35. Furber C, Bedwell C, Campbell M, et al. The challenges and realties of diaper area cleansing for parents. *J Obstet Gynecol Neonatal Nurs*. 2012;41(6):E13-E25.
36. Doughty D, Junkin J, Kurz P, et al. Incontinence-associated dermatitis: consensus statements, evidence-based guidelines for prevention and treatment, and current challenges. *J Wound Ostomy Continence Nurs*. 2012;39(3):303-315.
37. Beeckman D. A decade of research on incontinence-associated dermatitis (IAD): evidence, knowledge gaps and next steps. *J Tissue Viability*. 2017;26:47-56.
38. Heimall LM, Storey B, Stellar JJ, Davis J. Beginning at the bottom: evidence-based care of diaper dermatitis. *Am J Matern Child Nurs*. 2012;37(1):10-16.
39. Lichterfeld A, Hauss A, Surber C, Peters T, Blume-Peytavi U, Kottner J. Evidence-based skin care a systematic literature review and the development of a basic skin care algorithm. *J Wound Ostomy Continence Nurs*. 2015;42(5):501-524.
40. Bartels NG, Scheufele R, Prosch F, et al. Effect of standardized skin care regimens on neonatal skin barrier function in different body areas. *Pediatr Dermatol*. 2010;27(1):1-8.
41. Liu N, Wang X, Odio M. Frequency and severity of diaper dermatitis with use of traditional Chinese cloth diapers: observation in 3 to 9 month old children. *Pediatr Dermatol*. 2011;28(4):380-386.
42. Odio M, Thaman L. Diapering, diaper technology, and diaper area skin health. *Pediatr Dermatol*. 2014;31:9-14.
43. Clark-Greuel JN, Helmes CT, Lawrence A, Odio M, White JC. Setting the record straight on diaper rash and disposable diapers. *Clin Pediatr*. 2014;53(9S):23S-26S.
44. Babu MC, Tandur B, Sharma D, Murki S. Disposable diapers decrease the incidence of neonatal infections compared to cloth diapers in a level II neonatal intensive care unit. *J Trop Pediatr*. 2015;16:250-254.
45. Baer EL, Davies MW, Easterbrook KJ. Disposable nappies for preventing napkin dermatitis in infants. *Cochrane Database Syst Rev*. 2006;(3):CD004262.
46. Visscher MO. Recent advances in diaper dermatitis: etiology and treatment. *Pediatr Health*. 2009;3(1):81-98.
47. Berg RW, Milligan MC, Sarbaugh FC. Association of skin wetness and pH with diaper dermatitis. *Pediatr Dermatol*. 1994;11(1):18-20.
48. Davis JA, Leyden JJ, Grove GL, Raynor WJ. Comparison of disposable diapers with fluff absorbent and fluff plus absorbent polymers: effects on skin hydration, skin pH, and diaper dermatitis. *Pediatr Dermatol*. 1989;6(2):102-108.

49. Atherton DJ. A review of the pathophysiology, prevention and treatment of irritant diaper dermatitis. *Curr Med Res Opin*. 2004;20(5):645-649.
50. Association of Women's Health Obstetric and Neonatal Nurses. *Neonatal Skin Care Evidence-Based Clinical Practice Guideline*. 3rd ed. Washington, DC: Association of Women's Health, Obstetric and Neonatal Nurses; 2013.
51. Ehretsmann C, Schaefer P, Adam R. Cutaneous tolerance of baby wipes by infants with atopic dermatitis, and comparison of the mildness of baby wipe and water in infant skin. *J Eur Acad Dermatol Venereol*. 2001;15(S1):16-21.
52. Austin AP, Milligan MC, Pennington K, Tweito DH. A survey of factors associated with diaper dermatitis in thirty-six pediatric practices. *J Pediatr Health Care*. 1988;2(6):295-299.
53. Tsai TF, Maibach HI. How irritant is water? An overview. *Contact Dermatitis*. 1999;41:311-314.
54. Kubiak M, Kressner B, Raynor W, Davis J, Syversib RE. Comparison of stool containment in cloth and single-use diapers using a simulated infant feces. *Pediatrics*. 1993;91(3):632-637.
55. Guest JF, Greener MJ, Vowden K, Vowden P. Clinical and economic evidence supporting a transparent barrier film dressing in incontinence-associated dermatitis and peri-wound skin protection. *J Wound Care*. 2011;20(2):76-84.
56. Nnoruka EN, Daramola OOM, Ike SO. Misuse and abuse of topical steroids: implications. *Expert Rev Dermatol*. 2007;2(1):31-40.
57. Bulus AD, Andiran N, Koçak M. Cushing's syndrome: hidden risk in usage of topical corticosteroids. *J Pediatr Endocrinol Metab*. 2014;27(9):977-981.
58. Ho CW, Loke KY, Lim YY, Lee YS. Exogenous Cushing syndrome: a lesson of diaper rash cream. *Horm Res Paediatr*. 2014;82(6):415-418.
59. Farahani LA, Ghobadzadeh M, Yousefi P. Comparison of the effect of human milk and topical hydrocortisone 1% on diaper dermatitis. *Pediatr Dermatol*. 2013;30(6):725-729.
60. Mack KH. *The Best Practice Guideline for the Treatment of Pediatric Diaper Dermatitis*. Columbia, SC: University of South Carolina; 2010.
61. Espirito SA, Choquette A. Experience of adapting and implementing an evidence-based nursing guideline for prevention of diaper dermatitis in a paediatric oncology setting. *Int J Evid Based Healthc*. 2013;11(2):121-127.
62. Alonso C, Larburu I, Bon E, González MM, Iglesias MT, Urreta I, Emparanza JI. Efficacy of petrolatum jelly for the prevention of diaper rash: A randomized clinical trial. *J Spec Pediatr Nurs*. 2013;18(2):123-132.
63. Bartels NG, Lünnemann L, Stroux A, Kottner J, Serrano J, Blume-Peytavi U. Effect of diaper cream and wet wipes on skin barrier properties in infants: A prospective randomized controlled trial. *Pediatr Dermatol*. 2014;31(6):683-691.
64. Wananukul S, Limpongsanuruk W, Singalavanija S, Wisuthsarewong W. Comparison of dexpanthenol and zinc oxide ointment with ointment base in the treatment of irritant diaper dermatitis from diarrhea: A multicenter study. *J Med Assoc Thailand*. 2016;89(10):1654-1658.
65. Panahi Y, Sharif MR, Sharif A, Beiraghdar F, Zahiri Z, Amirchoopani G, Marzony ET, Sahebkar A. A randomized comparative trial on the therapeutic efficacy of topical aloe vera and calendula officinalis on diaper dermatitis in children. *Scientific World Journal*. 2012,2012:810234. doi: 10.1100/2012/810234.
66. Adib-Hajbaghery M, Mahmoudi M, Mashaiekhi M. The effects of bentonite and calendula on the improvement of infantile diaper dermatitis. *J Res Med Sci.*2014;19(4):314-318.
67. Adib-Hajbaghery M, Mahmoudi M, Mashaiekhi M. Shampoo-clay heals diaper rash faster than calendula officinalis. *Nurs Midwifery Stud.*2014;3(2), 1-4.
68. Gozen D, Caglar S, Bayraktar S, Atici F. Diaper dermatitis care of newborns human breast milk or barrier cream. *J Clin Nurs*. 2014;23(3-4):515-523.
69. Mahmoudi M, Adib-Hajbaghery M, Mashaiekhi M. Comparing the effects of bentonite & calendula on the improvement of infantile diaper dermatitis: A randomized controlled trial. *Indian J Med Res*. 2015;142(6):742-746.
70. Keshavarz A, Zeinaloo AA, Mahram M, Mohammadi N, Sadeghpour O, Maleki MR. Efficacy of traditional medicine product henna and hydrocortisone on diaper dermatitis in infants. *Iranian Red Crescent Med J*. 2016;18(5):e24809.
71. Nourbakhsh SM, Rouhi-Boroujeni H, Kheiri M, Mobasheri M, Shirani M, Ahrani S, Karami J, Hafshejani ZK. Effect of topical application of the cream containing magnesium 2% on treatment of diaper dermatitis and diaper rash in children: A clinical trial study. *J Clin Diagn Res*. 2016;10(1):WC04-WC06.
72. Qiao XP, Ge YZ. Clinical effect of hydrocolloid dressings in prevention and treatment of infant diaper rash. *Exp Ther Med*. 2016;12(6):3665-3669.

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