

**In this issue...**

We'll review the sources and causes of contact irritant dermatitis, its impact on health care and quantitative ways to measure the effectiveness of skin health solutions.

**Did you know...**

Dermatitis accounts for 15% to 20% of all occupational diseases and costs more than one billion dollars annually.

## Measuring the delivery of skin health benefits

Contact irritant dermatitis is ranked as one of the top concerns of health-care practitioners, with skin diseases ranked as the number one cause of occupational illness across all professions. According to a National Institute for Safety and Health (NIOSH) study, combined irritant and Type IV or chemical-induced dermatitis account for 15% to 20% of all occupational diseases and incur costs of more than *one billion* dollars annually.<sup>1</sup> Of these contact dermatitis cases, 75% can be classified as irritations. A study by Elaine Larson, et al in *Heart and Lung* journal showed that of 410 nurses, almost 86% reported that they had problems with their hands at some time, and the clinical assessment revealed that many of those had "significant skin damage."<sup>ii</sup>

Contact dermatitis is an inflammation of the skin evidenced by itching, redness and various skin lesions due to contact with an irritating substance. The frequent hand washing and gloving required in health-care occupations can have detrimental effects on skin, including dryness, cracking and increased sensitivity to hand-washing products. Clinicians' frequent occupational exposure to various soaps, detergents, disinfectants and other caustic chemicals are known to cause changes to the skin, which can be aggravated further by seasonal low humidity.

Because of these issues and their link to infections, there has been a great deal of interest in new glove products and other products that contain additives known to moisturize or otherwise benefit the skin. However, quantitative measures detailing whether these additives actually have a beneficial effect on skin have been lacking.

A key consideration when assessing gloves and other products designed to improve skin health is to examine the available test data that specifically demonstrate the benefit of the product in actual or simulated clinical use using recognized tests developed by dermatologists.

### Hand dermatitis: a significant health-care issue

Irritation or contact dermatitis is a non-allergic reaction. Though clinicians frequently describe their reactions as allergic in nature, irritations are not an immunological response, but simply an irritant response to any number of substances or factors. There are two types of irritations, acute and chronic.

Acute dermatitis	Chronic dermatitis
<ul style="list-style-type: none"> <li>• Rapid onset</li> <li>• Severe in nature</li> <li>• Manifests for a short period of time</li> <li>• Redness, itching and possibly burning sensation</li> </ul>	<ul style="list-style-type: none"> <li>• Gradual onset</li> <li>• Localized to the area in contact with the irritant</li> <li>• Longer duration</li> <li>• Cracks, fissures, hard bumps and sores</li> </ul>

Table 1: Typical characteristics/symptoms of acute vs. chronic dermatitis

### Sources and causes of irritations

Alcohol-based products in the form of gels, rinses, rubs and foams have recently gained popularity. Frequent use of alcohol-based formulations can cause drying of the skin unless emollients, humectants or other skin-conditioning agents are added. Even well-tolerated alcohol hand rubs containing emollients may cause a transient stinging sensation at the site of any broken skin. Though they are recognized as having increased compliance and

adherence in routine hand hygiene, there are also reports of clinicians experiencing irritant dermatitis to these products as well. The Centers for Disease Control and Prevention (CDC) stated that it anticipates an increase in reports of irritant and even allergic contact dermatitis as more of these products are made available.<sup>iii</sup>

All surgical scrub solutions have been known to cause irritant dermatitis. The frequency of skin irritation is concentration-dependant. Products containing 4% chlorhexidine gluconate are most likely to cause dermatitis when used frequently for antiseptic hand washing.

Gloves may also be the source of an irritant reaction. Glove powder is a common cause of irritant reactions, especially in exam glove wearers. The simple practice of donning and removing gloves, especially if not properly sized, may cause friction across the dorsum of the hand (knuckles) and develop into a reddened irritant reaction.

It is common practice for clinicians to use over-the-counter hand lotions and moisturizers in the clinical environment. From an infection-prevention standpoint, this is an unacceptable practice since these products may harbor and grow infectious microorganisms and are not approved for use in the health-care setting. Most of these products are highly fragranced, are not compatible with other hand hygiene products and can be the source of either an acute or chronic irritation.

A more delicate issue to address with clinicians is that related to age. It is well documented and has been profoundly recognized that the nursing population is aging. The majority of practicing nurses today are over 40 years old and the average age of an operating room nurse is 48.7 years old. This population is at greater risk for dry skin. Another recently recognized phenomena is that the younger populations, the 20- to 30-year-olds, are experiencing an increase in dermal reactions as well. The research and causality behind this is still evolving.

Sources/Cause	Issue	Solution
Alcohol-based products including gels, rinses, rubs and foams	Frequent use can cause drying of the skin	Use products with added emollients, humectants or other skin-conditioning agents
Surgical scrub solutions	Can cause irritant dermatitis (frequency of skin irritation is concentration-dependent)	Products containing 4% chlorhexidine gluconate are most likely to cause dermatitis when used frequently for antiseptic hand washing – avoid these if possible
Gloves, including glove powder, chemicals and accelerants used during manufacture and glove pH	Common sources of irritant reactions	Select gloves that conform to individual clinician needs
Glove donning/removal	Can cause friction across the dorsum of the hand (knuckles) resulting in a reddened irritant reaction, especially if not properly sized	Ensure correct glove sizing for clinicians, don and remove gloves carefully
Use of over-the-counter hand lotions and moisturizers	Because most products are highly fragranced, they are not compatible with other hand hygiene products and can be the source of either acute or chronic irritation	Discontinue use. Note: because these products may harbor and grow infectious microorganisms, they are unacceptable from an infection-prevention standpoint

Table 2: Sources and causes of skin irritation

## How skin health can affect hand hygiene

Damaged hands become a deterrent to hand washing because washing can worsen skin problems. Studies published in the *American Journal of Infection Control* report that skin breakdown is “a major occupational health problem among health-care workers, not only nurses and others with direct patient contact, but also laboratory personnel and persons working in house-keeping and building maintenance.”<sup>iv</sup>

These and other studies published in the *American Journal of Infection Control* have demonstrated that, with skin trauma, there is increased shedding of damaged skin cells. Also, chronic dermatitis has been associated with heavier colonization of bacteria, yeast, staphylococci and other potential pathogens and outbreaks of health-care-acquired infection.<sup>v</sup> Clearly, improving hand condition of clinicians is greatly needed.

## CDC guideline for hand hygiene in health care

The recently published CDC document *Guideline for Hand Hygiene in Health-Care Settings*<sup>vi</sup> addresses the issues that can result in a higher incidence of nosocomial infections among patients and notes that a key reason clinicians do not adhere to recommended hygiene guidelines is skin irritation. The guidelines specifically recommend that health-care workers select products that contain emollients in order to reduce the potential for contact irritant dermatitis.

## Patient outcomes

The Institute of Medicine recently reported that as many as 98,000 patients a year contract a hospital-related infection that was preventable. It is also believed that many of these infectious agent transmissions could have been prevented by simple hand hygiene. The hands of clinicians with compromised skin (a skin barrier that is breached by open lesions or cracks) may harbor an increased amount of infectious organisms compared to individuals with healthy, intact skin. Dry skin may shed or flake more than healthy skin. Since organisms can be shed along with skin flakes, this may increase the likelihood that organisms can be transmitted to patients. Patients may acquire a nosocomial infection by simple contact of a gloved or non-gloved hand.

## Employee outcomes

Employees with compromised skin are at an increased risk of occupational exposure to potentially infectious organisms such as hepatitis B or C or even HIV. Broken skin provides a more direct route for an organism to enter an individual’s blood stream. Employees are also at increased risk for exposure to contact organisms such as *Staphylococcus aureus* and *Escherichia coli*. Dermatic hands may also result in lost productivity and impact job satisfaction and employee morale.

## The impact on clinical practice

Products that promote and maintain healthy skin will result in increased compliance and frequency of hand washing and hand hygiene in health-care providers. It is specifically stated in the CDC guidelines that employers should “provide personnel with efficacious hand hygiene products that have low irritancy potential, particularly when these products are used multiple times per shift.”<sup>vii</sup>

In light of these new guidelines, clinicians, especially infection control professionals, have a renewed interest in products that promote and maintain healthy skin. They are using these guidelines to support their rationale and justification to purchase products. Products that reduce trans-epidermal water loss, increase skin hydration (moisturize), have low irritancy potential and improve skin tolerance can increase adherence to hand washing and hand hygiene and will be integral to an overall hand-care and skin wellness program.

## The link between nosocomial infections and skin health

Health-care workers are not fully adhering to recommended hand-washing procedures. While lack of time and poor technique play some role in this issue, infection control professionals are recognizing the direct link between skin health and nosocomial (health-care-associated) infections.

Repeated use of hand scrubs and hand-washing products has been cited as one of the contributing factors to dermatitis. Commonly reported irritants include iodophors, chlorhexidine, PCMX, triclosan and alcohol-based products. Numerous articles note that failure to use supplemental hand lotions or creams is

### Potential impact of poor hand hygiene and compromised skin health

- Higher nosocomial infection rate among patients
- Increased risk for clinicians of occupational exposure to potentially infectious organisms
- Lost productivity
- Lower job satisfaction and employee moral

one of the factors contributing to dermatitis associated with frequent hand-washing activity.<sup>viii</sup> Several controlled trials have demonstrated that regular use of hand lotions or creams helps prevent and treat irritant contact dermatitis.<sup>ix</sup>

### Key dermatological measures of skin health and damage

Various physical properties of the skin are important in the development of an irritant skin response. The following noninvasive measuring methods have been used to investigate these properties and assess the health or degree of damage to the skin:

#### Trans-epidermal water loss (TEWL)

The passive diffusion of water loss through the stratum corneum relates directly to skin integrity. In other words, compromised skin tends to lose more moisture than normal skin. Using an evaporimeter, which records the total water evaporation from the skin, the TEWL test measures the integrity of the stratum corneum when relative humidity, temperature and sweating are controlled. A number of studies have demonstrated that the skin's TEWL values are significantly increased after irritant exposure.<sup>x</sup>

#### Electrical conductance

The moisture content (hydration state) of normal skin is significantly decreased, and the response to irritants and occurrence of skin irritation are increased during the winter months.<sup>xi</sup> Various electrical methods can be used to measure changes in skin hydration.

#### Colorimetry

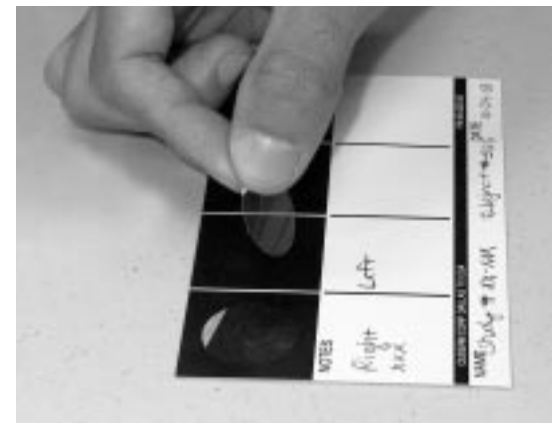
Changes in erythema (redness) correlate well with visually scored skin damage. A chromameter is a colorimeter used to quantify differences in skin redness.



Changes in the firmness and viscoelasticity can be measured using a Cutometer® instrument

### Firmness and elasticity

The skin's viscoelasticity (e.g., stickiness and stretchiness) is due to its collagen and elastin fibers. The stratum corneum must be intact and flexible to function effectively. When the stratum corneum is damaged, it becomes dry, tight and inelastic. At its worst, it is cracked, providing avenues for infection. The Cutometer® instrument operates a suction perpendicular to the skin surface to measure the amount of deformation of the skin. This measure can then be related to the firmness and elasticity of the skin.



The D-squames® disc is placed on the skin for a few moments, then transferred to a test card for comparison to control samples

#### D-squames® tapes

D-squames® tape disks are constructed from a clear grade of polyester support film and a super-clear adhesive. They are used to sample the outer dead skin layers. The disk is analyzed by determining the size of the dead cells (fine, medium or coarse). The finer the cells are, the more moist the skin. Damaged skin sheds and flakes more than normal skin.

### Applying dermatological test results to glove selection

A clinician's intact skin is his or her first line of defense against microorganisms, chemicals and other fluids. As a result, there has been a great deal of interest in new glove products and other products that contain additives known to moisturize or otherwise benefit the skin. However, quantitative measures detailing whether these additives actually have a beneficial effect on skin have been absent.

**Key questions to consider when choosing a glove with skin-beneficial additives:**

- Rapid onset
- How were products tested and on what population?
- Did testing simulate actual glove usage?
- Are the beneficial additives present in high enough amounts to significantly impact hand health?
- Did clinicians provide input to the development?
- What tests were used to evaluate efficacy?

Gloves and skin care products containing various additives designed to improve skin health will provide vastly different skin benefits depending on the ingredient selected, the amount of the ingredient present and the formulation of the product. A key consideration when

assessing these products is to examine the available test data that specifically demonstrate the benefit of the product in actual or simulated clinical use conditions using “gold standard” tests developed by dermatologists. By understanding these issues and test methods, clinicians can more effectively evaluate the efficacy of gloves or other products containing additives designed to improve skin health and integrity.

These quantitative results can ensure that practitioners – and ultimately the health-care organization – are receiving the full benefits these gloves and other products have to offer and are well prepared to deal with the significant issue of dermatitis.

Cutometer is a registered trademark of Courage and Khazaka Electronic GMBH.

D-squames is a registered trademark of Cuderm Corporation.

Test method	Test description	Test results should demonstrate:
<b>D-Squames®</b>	Measures skin smoothness/flakiness by analyzing the outer dead cell layers	Finer cell definition (indicating moister skin) and less skin flaking of skin
<b>Evaporimetry</b>	Records the total water evaporation from the skin, an indicator of the passive diffusion of water through the stratum corneum (trans-epidermal water loss)	Decrease in the rate of total water evaporation from the skin, indicating higher skin integrity
<b>Cutometry</b>	Pulls and releases the skin to evaluate viscoelastic (sticky and stretchy) skin properties	Skin returns quickly to its normal state
<b>Conductance</b>	Measures skin surface moisturization	Higher overall skin moisturization

Table 5: Standard test methods for evaluating skin product effectiveness

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Cardinal Health  
Glove Products  
1500 Waukegan Road  
McGaw Park, IL 60085

[www.cardinal.com/gloves](http://www.cardinal.com/gloves)

