

**3M** Science.  
Applied to Life.™

A comprehensive  
guide to understanding  
and reducing the risk of

# MARSI

Medical Adhesive-Related Skin Injuries



# Patient care starts with skin.

Skin is the body's first line of defence against infection. The products you choose to use, as well as how you apply and remove them, may impact the skin more than you might realize.



Medical adhesives are a critical part of healthcare, used by virtually every provider across a variety of settings. If not used properly, adhesive products may cause medical adhesive-related skin injury, or MARSI – a prevalent but under-recognized complication that can be serious enough to require additional treatment.

This guide is designed to help you better understand MARSI so you're better equipped to help protect your patients.

It covers

- What MARSI is
- Why it occurs
- Who's at risk
- Why MARSI is relevant to your practice
- How you can reduce the risk



## Best practices from recognized experts

Much of the information in this guide was developed by a panel of 23 recognized key opinion leaders in skin and wound care who convened to establish consensus statements on the assessment, prevention and treatment of MARSI. The resulting document, **Medical Adhesives and Patient Safety: State of the Science**, can be purchased and downloaded online.





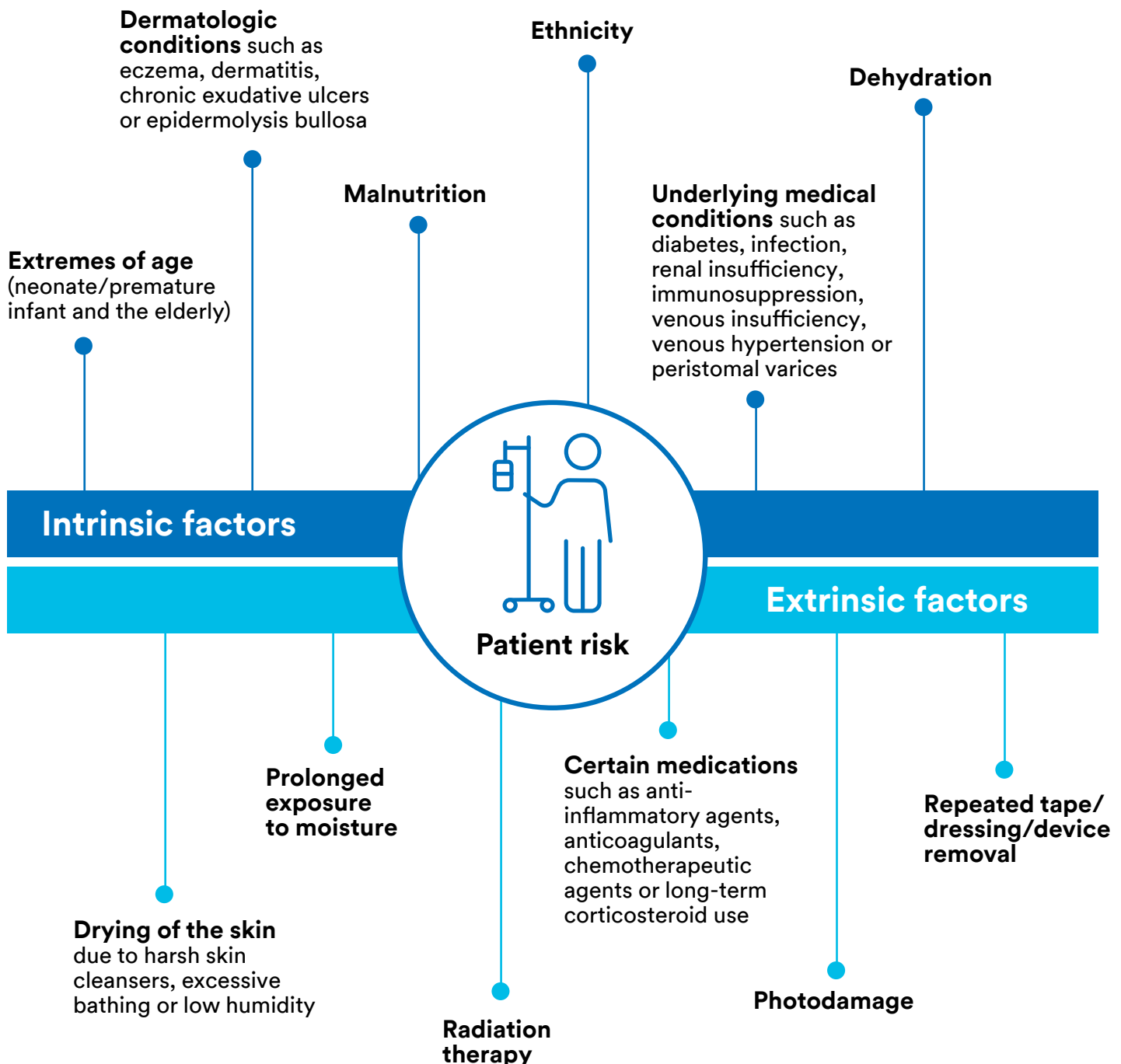
# What is MARSI?

MARSI is damage to the skin that may occur when medical adhesives are not selected, applied and/or removed properly. In mild cases, there may not be any visible trauma. But in other cases, the injury can be more serious, requiring additional treatment. MARSI can cause pain, increase the risk of infection and delay healing – all of which can reduce a patient's quality of life.<sup>1</sup>

One way MARSI occurs is during adhesive removal, when the bond between the skin and the adhesive is stronger than the bond between the skin's layers – meaning the skin cells actually separate when the adhesive is removed.

# Why MARSI occurs

According to the *Medical Adhesives and Patient Safety: State of the Science* consensus document, the pathophysiology of MARSI is only partially understood. But there are a number of intrinsic and extrinsic factors that can influence a patient's risk.<sup>3</sup>



# Preventable causes of MARSI

The consensus document also notes that the use of adhesive products also plays a role in enhanced susceptibility to skin injury, and they identified a number of preventable causes.

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## Improper choice of tape

- Using tape with more adhesion than needed for the patient and application
- Wrong choice of tape (e.g., not using a tape with stretch for an area where swelling or movement is anticipated)




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## Improper application technique

- Tension on application (e.g., strapping)
- Applying in the wrong direction (i.e. not allowing stretch in the direction of expected swelling/movement)
- Applying to wet/moist skin
- Use of alcohol-based skin preps, which are drying to the skin
- Not allowing skin preps/barriers to dry
- Not clipping/trimming hair prior to application
- Excessive use of substances that increase the stickiness of adhesives (e.g., tackifiers, bonding agents)




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## Improper removal technique

- Quick removal
- Removal at a high angle
- Insufficient support of the skin at the peel line when removing the adhesive product

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## Leaving occlusive tapes or dressings on too long

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## Repeated taping or dressing changes

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## Dehydration

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# Who's at risk for MARSI

While any patient who comes in contact with medical adhesives can potentially experience MARSI, certain groups of people are more vulnerable. Identifying these higher-risk patients and taking special care with them by choosing the right adhesive for the right application and using those adhesives properly are key parts of risk reduction.



## Infants

Neonatal skin is 40% to 60% thinner than adult skin, largely due to the presence of fewer epidermal cell layers in the stratum corneum.<sup>2</sup> The most common form of MARSI seen in neonatal patients is skin stripping. Chronically hospitalized infants may also experience irritant contact dermatitis due to the variety of adhesive products they encounter.<sup>4</sup>

## Elderly patients

Skin changes that are part of the aging process can increase the risk of skin injury in older adults.

These changes include

- Loss of dermal matrix and subcutaneous tissue
- Epidermal thinning
- Reduced cohesion between the dermal and epidermal layers
- Reduced vascularity, elasticity and tensile strength
- Loss of moisture<sup>3</sup>



**8%**  
of hospitalized  
infants and children

In a one-day prevalence audit, 8% of hospitalized infants and children were found to have tape-related skin stripping.<sup>3</sup>



**15.5%**  
of long-term  
care patients

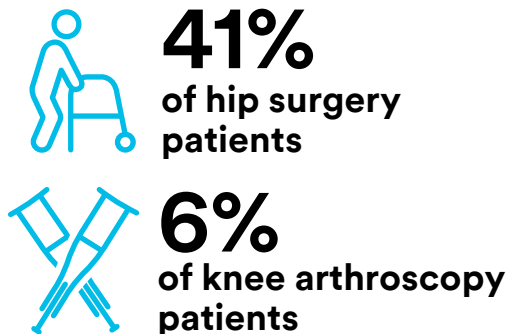
In one study of long-term care (LTC) patients, the cumulative incidence of skin injury caused by adhesive tape was 15.5% (38 incidents per 1,000 person-days).<sup>3</sup>





## Orthopedic surgery patients

Skin injuries are more prominent among orthopedic surgery patients due to the large amounts of tape used to secure large compression bandages. The risk of skin damage is then compounded by joint movement, skin friction and the presence of tissue edema, which creates a strapping effect.<sup>5</sup>



The incidence of tension blisters has been reported to be as high as 41% following hip surgery, and as high as 6% following knee arthroscopy.<sup>3</sup>

## Other higher-risk patients include

- Those with chronic skin conditions such as eczema, dermatitis, chronic ulcers and epidermolysis bullosa
- Those with underlying medical conditions such as diabetes, infections, renal insufficiency, immunosuppression, venous insufficiency or hypertension
- Oncology patients
- Steroid-dependent patients
- Dialysis patients
- ICU patients
- Patients undergoing radiation treatment
- Patients suffering from malnutrition or dehydration

# Why MARSI is relevant to your practice

There are three risk factors that are critical to health outcomes: patients, products and application.



## Clinical impact

Choosing a high-adhesion tape for use on fragile skin may result in MARSI, which can cause pain, increase the risk of infection and delay healing.<sup>1</sup>



## Cost impact

MARSI doesn't just affect clinical outcomes and patient well-being. It may also contribute to higher care costs, which can burden the healthcare system as a whole.



## Patient impact

Not choosing the right medical adhesive may negatively impact the patient, affecting everything from their care experience to your facility's satisfaction scores.



**55**  
treatments

For every 100 patients who receive a medical tape application, 55 treatments for MARSI will be needed.<sup>6</sup>



**125x**  
greater cost

The average tape-induced skin injury costs \$88.50 US to treat, which is 125 times greater than the average cost of one roll of plastic tape.<sup>6</sup>



**62%**  
of clinicians

In one survey, 62% of clinicians indicated their current medical tapes do not meet the needs of patients with fragile skin.<sup>7</sup>



## Ratings and reimbursement

Hospitals and care facilities are increasingly being rated and reimbursed based on patient satisfaction. Reducing the risk of MARSI is one more way to help achieve positive outcomes that can lead to positive ratings.

# 3 steps to help reduce the risk of MARSI

While there are a variety of ways to help reduce the risk of MARSI, the most important things can be summarized in just three steps.



## Assess

the patient's age, medical history and skin conditions.



## Select

the right adhesive product for the patient and application.



## Use

appropriate adhesive application and removal techniques.



# Assess

## General assessment

Before conducting an in-depth assessment of the patient's skin, it's important to examine the broader context within which the patient and their condition exist.

### Be sure to note

- ☒ Age
- ☒ Co-morbidities
- ☒ Medication
- ☒ Allergy sensitivities
- ☒ Nutritional status

### Allergy/sensitivity assessment

The consensus document also notes that it's important to obtain a history of the patients' known or suspected allergies and sensitivities to minimize the risk of MARSI. This helps to eliminate the risk of dermatitis.<sup>3</sup>

**Medical adhesives** are a common cause of non-allergic irritant contact dermatitis and such reactions are more likely to occur with extended exposure.<sup>3</sup> Allergic contact dermatitis related to adhesive products is less common, though numerous reports of allergic reactions to components of adhesive products can be found in the literature.<sup>3</sup>

## Skin assessment

It's a widely accepted standard of care that skin be assessed on all patients on admission to a healthcare facility. In order to make a positive impact on skin health, assessments for patients at higher risk for skin breakdown need to be conducted more frequently, and closer observation to warning signs needs to be observed.

Skin assessment requires thorough observation and data collection, followed by interpretation. Good lighting is essential for this process.

### The skin should be assessed for

- ☒ Colour
- ☒ Texture
- ☒ Uniformity of appearance
- ☒ Integrity

### Any lesions should be described accurately with regard to

- ☒ Type
- ☒ Colour
- ☒ Arrangement
- ☒ Size
- ☒ Distribution

**Accurate description** of the skin and any lesions can help distinguish adhesive-related skin damage from other non-traumatic dermatologic disorders or conditions, and may help identify an infection if present.





## What happens if MARSI is noted during assessment?

If MARSI is noted during a skin assessment or device change, the injury should be assessed and the severity determined in order to guide management.

**Mechanical injuries** such as skin stripping, tension injuries and skin tears may be assessed as general wounds and classified according to depth (e.g., superficial, partial thickness or full thickness).<sup>3</sup>

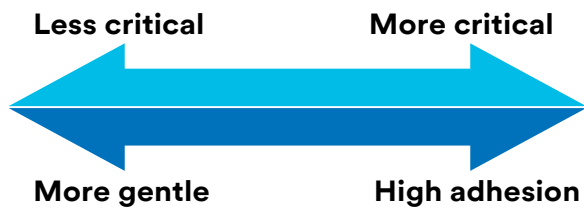
**Irritant and allergic dermatitis** are difficult to distinguish from one another, but a thorough assessment may help identify key features and enable determination of severity, thus guiding appropriate management.<sup>3</sup> Identifying allergic dermatitis is important as the patient should be advised to avoid the same or similar materials in the future.

Assessment for evidence of infection should be performed in all cases of MARSI.



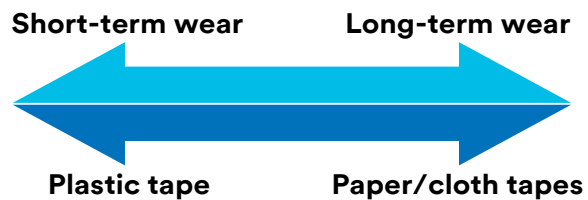
# Select

Choosing the right medical adhesive for the right situation is critical to patient care. According to the ***Medical Adhesives and Patient Safety: State of the Science*** consensus document, clinicians should consider the following factors when selecting an adhesive product.<sup>3</sup>



## 1. Intended use of the product

The foremost patient consideration is the intended use or purpose of the product (e.g., securement of a critical device, non-critical device or dressing, wound closure, etc.). Depending on the application, clinicians must balance the need for adhesion and gentleness.



## 2. Anticipated wear time

The intended use of the product directly influences anticipated wear time. Some tape materials are better suited for either short- or long-term wear, meaning clinicians should consider the trade-offs between tapes with plastic backing versus paper or cloth backing.



## 3. Anatomical location

If the location has potential for skin distention or movement (e.g., areas with joint articulation or in cases of edema), the risk of adhesive-related skin damage may be reduced by using tapes that stretch and flex with the body.



## 4. Ambient conditions present at the site

Consider whether the area is smooth or contoured, or exposed to moisture, perspiration, humidity, exudate and/or body fluids. Some products are designed with these challenging conditions in mind.

## Making it easy to make the right medical tape decision

Generally speaking, most facilities have three types of securement needs: general securement, flexible securement and critical device/tube securement. 3M has made it easy to meet these securement needs while choosing the right tape for the patient and application, while also streamlining the number of medical tapes your facility carries. To learn more about 3M medical tapes and how they can help you reduce the risk of MARSI, visit [3M.ca/MedicalTapes](https://www.3m.ca/MedicalTapes).

### General Securement



- Blood draws
- Dressings
- IV lines and tubing
- Non-critical tubes

### Flexible Securement



- Long-wear compression
- Securement when swelling or movement is anticipated

### Critical Device/Tube Securement



- Central venous catheter
- Foley catheter
- Nasogastric tube
- Endotracheal tube
- Chest tube
- Orogastric tube
- Surgical drain tube

Ideal for fragile/at-risk skin

Ideal for intact skin (for at-risk skin, use a barrier like 3M™ Cavilon™ No Sting Barrier Film)

#### Extra gentle



3M™ Kind Removal  
Silicone Tape

#### Multi-purpose



3M™ Transpore™ White  
Surgical Tape

#### Flexible



3M™ Medipore™ H Soft Cloth  
Surgical Tape

#### High-adhesion



3M™ Durapore™ Advanced  
Surgical Tape

## Why single-patient-use products are preferred

US federal and Centers for Disease Control guidelines suggest that to help prevent cross-contamination, products like medical tapes should be dedicated for use on only a single patient.<sup>8</sup>



**74%**  
of tape rolls

In one study, 74% of partially used tape rolls from various sites within the hospital had some bacterial growth.<sup>9</sup>



## Use

The consensus document notes that proper application and removal of adhesive products is critical to minimizing skin damage and reducing the risk of MARSI. Here are some recommended steps to use as you apply and remove medical tapes.

### Prepare the skin



1. Clip/trim hair.
2. Clean and dry the skin to remove soil and/or residue from medical grade adhesive remover, moisturizer or lotion.
3. Apply 3M™ Cavilon™ No Sting Barrier Film to help protect at-risk skin.
4. Allow barrier film to dry completely before applying tape.
5. Avoid routine use of tackifiers.

### Using a barrier to protect your patients

The consensus document recommends using a skin barrier prior to applying an adhesive product, especially for patients at high risk for skin injury.

3M™ Cavilon™ No Sting Barrier Film is designed to help provide protection and comfort for patients who are vulnerable to MARSI. It's alcohol-free, sting-free and can be used on intact and damaged skin, making it a versatile solution for a variety of skin problems.



#### Benefits of a barrier film

In one study of skin complications around peripherally inserted central catheter (PICC) lines, local skin complications were noted in 62% of patients in the standard care group compared to just 6% in the barrier film group.<sup>10</sup>

**6%**

of patients experienced skin complications when a barrier film was applied.

**62%**

of patients experienced skin complications with standard care.



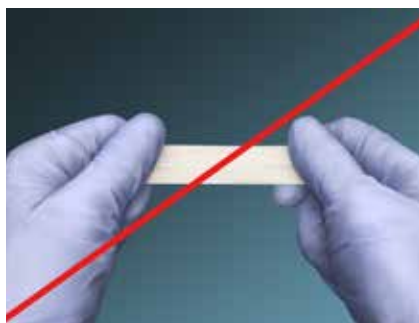
## Tape application techniques



1. Apply tape to skin without stretching or tension.



2. Apply firm pressure to activate the adhesive and gain full contact with the skin.



### Application tips

- Tape should not be pulled or stretched when applied.
- Minimize touching adhesive surface to retain adhesive levels.
- Avoid gaps and wrinkles that can allow moisture to get between the tape and the skin, tubing or dressing.
- Do not encircle a limb completely with tape.
- If swelling occurs, loosen and replace tape. 3M™ Kind Removal Silicone Tape can be repositioned without compromising adhesion.
- When securing dressings, tape should extend a minimum of one-half inch (one inch is preferred) beyond the edge of the dressing to hold the dressing in place.

## Tape removal techniques

Proper tape removal is critical in reducing the incidence of MARSI.

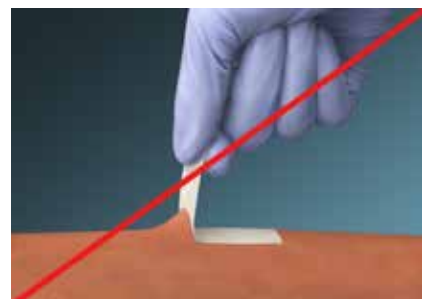


1. Loosen edge of tape.

**Tip:** To start the edge, press a small separate piece of tape onto a corner of the piece to be removed. This serves as a handle for lifting the edge of the tape.



2. Stabilize the skin with one finger at the peel line.
3. Remove tape “low and slow” in the direction of hair growth, keeping it close to (parallel with) the skin surface while pulling it back over itself.



4. Pulling tape at a vertical angle (perpendicular) to the skin will pull at the epidermis, increasing the risk of MARSI.
5. As tape is removed, continue to support the skin at the peel line.

**Tip:** For tape that is strongly adhered to skin or hair, consider using a medical-grade adhesive remover or moisturizer to soften the adhesive along the peel line (peel edge).

# Advancing the science of securement

Adhesive technology is a cornerstone of the 3M business. We invented the category of gentle-to-skin medical adhesives more than 50 years ago, and we've been innovating ever since to continue to improve the design and formulation of adhesive products to help you realize ever-better patient outcomes. Today we offer a full line of adhesive solutions that meet virtually every patient need and clinical application – helping you deliver a superior care experience.





<sup>1</sup>Cutting, K.F. Impact of adhesive surgical tape and wound dressing on the skin with reference to skin stripping. *J. Wound Care* 2008; 157-158, 160-162.

<sup>2</sup>Lund, C.H.; Tucker, J.A. Adhesion and newborn skin In: Hoath, S.B.; Maibach, H.I. eds. Neonatal skin: Structure and Function. 2nd ed. New York, NY: Marcel Dekker: 2003: 200-324.

<sup>3</sup>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. *J. WOCN*. 2013; 40(4): 365-380.

<sup>4</sup>Lund, C. Medical Adhesives in the NICU. *Newborn Infant. Nurs. Rev.* 2014; 14(4): 160-165.

<sup>5</sup>Jester, R.; Russell, L.; Fell, S.; Williams, S.; Prest, C. A one-hospital study of the effect of wound dressing and other related factors on skin blistering following total knee and hip arthroplasty.

<sup>6</sup>Maene, B. (2013). Hidden costs of medical tape-induced skin injuries. *Wounds UK*, 9(1), 46-50.

<sup>7</sup>Manriquez, S., BSN, RN, WOCN; Loperfido, B., MA, RN, NP; Smith, G., BS. (2014). Evaluation of a New Silicone Adhesive Tape among Clinicians Caring for Patients with Fragile or At-Risk Skin. *Advances in Skin and Wound Care*, 27(4).

<sup>8</sup>Federal Register Vol. 72, No. 73 Rules and regulations (73 FR 20373 4/15/2008).

<sup>9</sup>Love, K.L. Single-Patient Rolls of Medical Tapes, *Infection Control Today*, January 2013.

<sup>10</sup>George, M.; Pal, U.; Guduri, V.; Smith, G. Use of a skin protectant (3M™ Cavilon™ No Sting Barrier Film) to reduce local skin complications around PICC lines. *WCET Journal* 36(4) 8-13, October-December 2016.



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