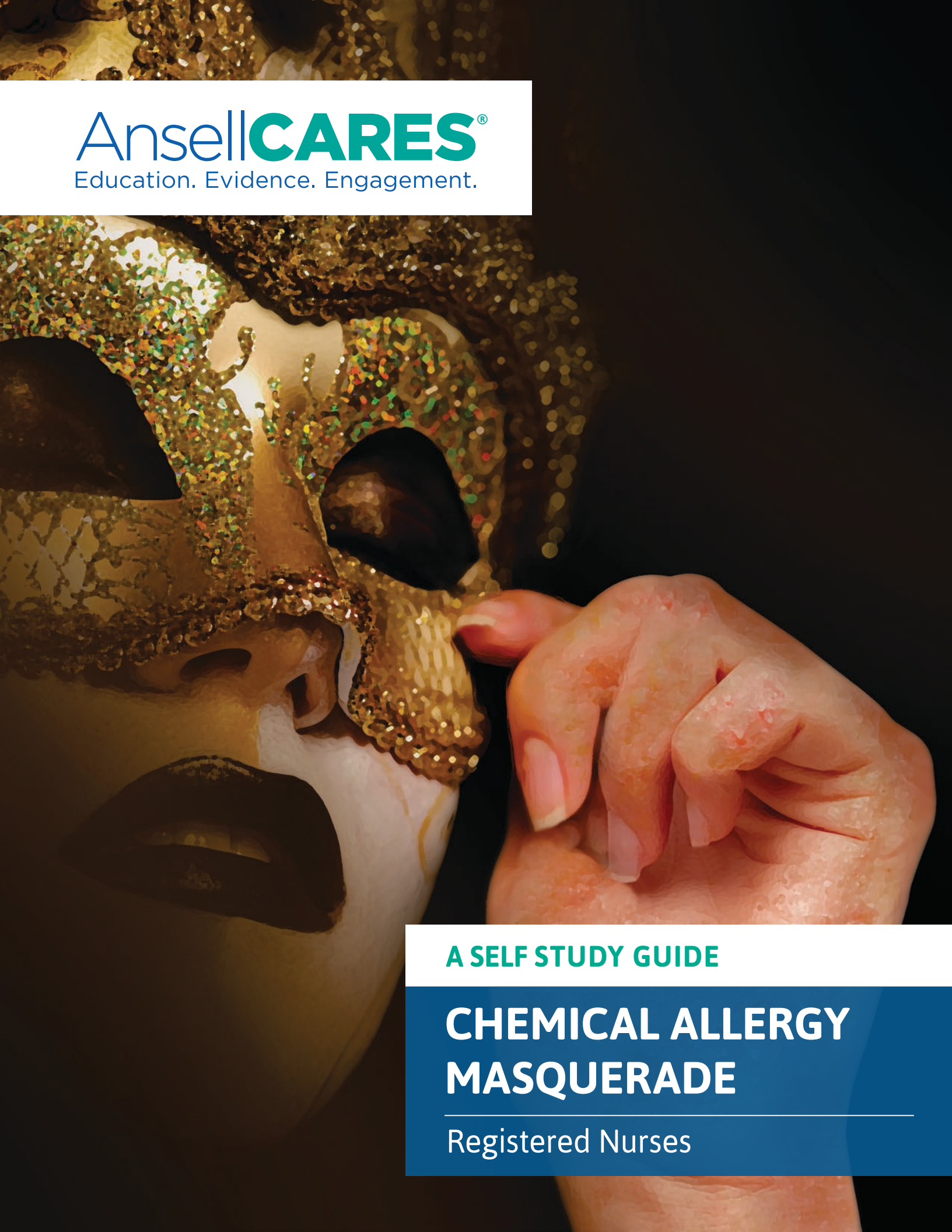

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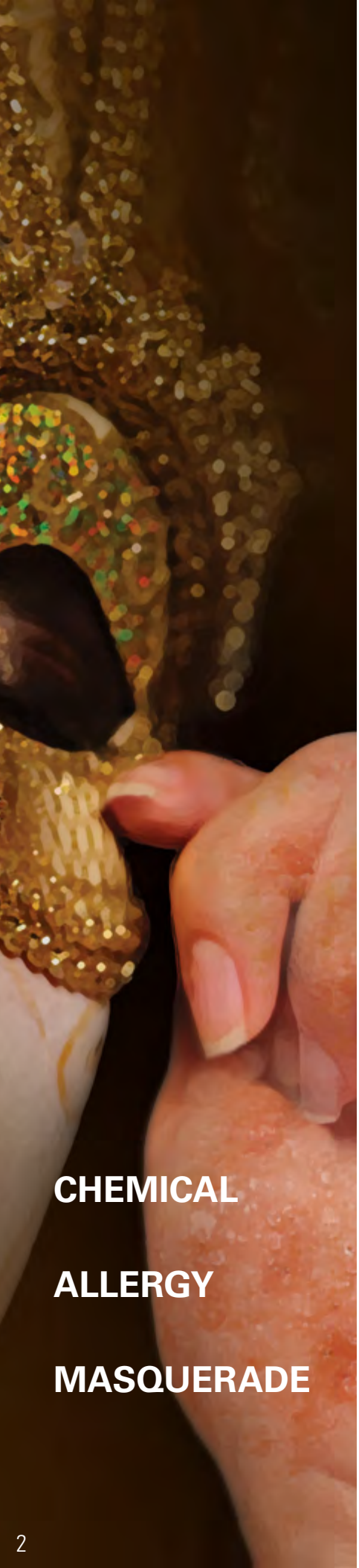
A SELF STUDY GUIDE

CHEMICAL ALLERGY MASQUERADE

Registered Nurses



OVERVIEW

Today, preventing transmissible infections in the surgical practice setting is more important than ever. The appropriate selection and use of personal protective equipment (PPE) are key components in all infection prevention strategies. In this regard, medical gloves are the most common type of PPE used to protect healthcare workers (HCWs) from occupational exposure to blood or other potentially infectious materials. As the use of gloves by HCWs continues to increase, so do concerns related to glove reactions. However, while many individuals may experience some type of a reaction to medical gloves, they often may not know the specific cause. In many cases, these reactions masquerade as allergies to the various chemicals used in the manufacture of medical gloves. This continuing education activity will present a review of the problem of chemical allergies associated with glove use today. The difference between latex and chemical allergies will be outlined. The incidence, causes, and symptoms of chemical allergies, followed by treatment options, will be reviewed. Effective strategies to reduce the risk of chemical allergies related to the use of medical gloves by health care workers will be discussed. Finally, key considerations in the selection and use of alternative medical glove products to minimize and/or prevent chemical allergies in the workplace will be described.

LEARNER OBJECTIVES

After completing this continuing education activity, you should be able to:

1. Define the difference between latex allergies and chemical allergies.
2. Identify the incidence, causes, and symptoms of chemical allergy.
3. Explain treatment options for chemical allergy.
4. Identify strategies to reduce chemical allergy risk.
5. Discuss how to select and use alternative medical glove products safely in the workplace to minimize or prevent chemical allergy.

INTENDED AUDIENCE

The information contained in this self-study guidebook is intended for use by healthcare professionals who are responsible for or involved in the following activities related to this topic:

- Educating healthcare personnel.
- Establishing institutional or departmental policies and procedures
- Decision-making responsibilities for safety and infection prevention products.
- Maintaining regulatory compliance
- Managing employee health and infection prevention services.

INSTRUCTIONS

Ansell is a Recognized Provider of continuing education by the California Board of Registered Nursing, provider #CEP 15538 and the Australian College of Perioperative Nurses (ACORN). This course has been accredited for 2 (two) contact hours. Obtaining full credit for this offering depends on completion of the self-study materials on-line as directed below.

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AN 85% PASSING SCORE IS REQUIRED FOR SUCCESSFUL COMPLETION.
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For more information about our educational programs or perioperative safety solution topics, please contact Ansell Healthcare Educational Services by e-mail at edu@ansellhealthcare.com

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As employees of Ansell Mrs. Ouellet, Mrs. Richardson, Mrs. Taylor and Ms. Werner have declared an affiliation that could be perceived as posing a potential conflict of interest with development of this self-study module. This module will include discussion of commercial products referenced in generic terms only.

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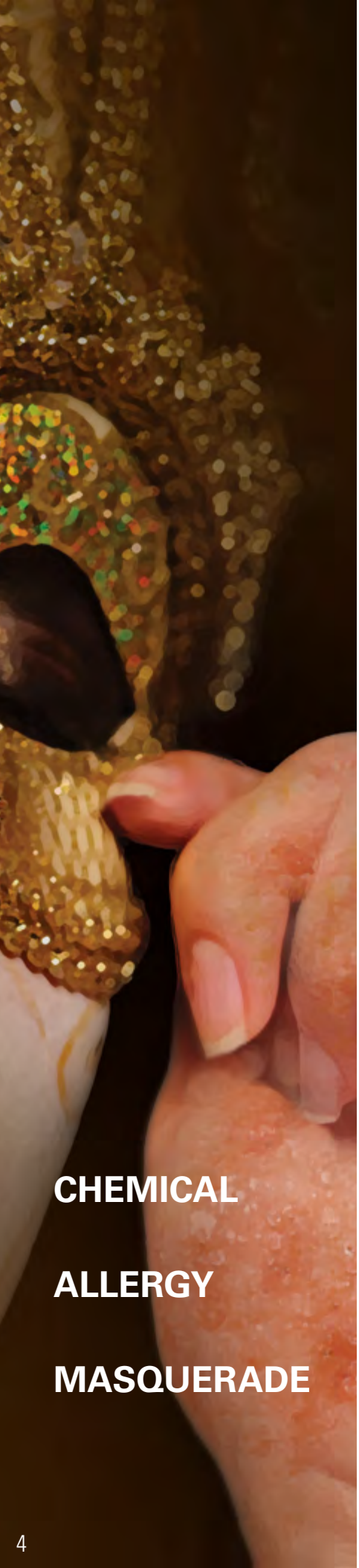


CHEMICAL ALLERGY MASQUERADE

INTRODUCTION

In the healthcare setting, protecting healthcare workers, as well as patients, from transmission of potentially infectious agents continues to be a primary goal for all members of the healthcare team.[1] The appropriate selection and use of personal protective equipment (PPE) are key strategies for achieving this goal.

The World Health Organization (WHO), the U.S. Occupational Health and Safety Administration's (OSHA's) Bloodborne Pathogen Standard, the European Agency for Safety and Health at Work (EU-OSHA), the National Institute for Healthcare and Care Excellence (NICE - UK) and the Australian National Occupational Health and Safety Commission (NOHSC) all defines PPE as the specialized clothing or other equipment worn by employees to protection themselves against a hazard; the use of PPE is required whenever there is a risk for occupational exposure to blood or other potentially infectious material.[2] In addition, Standard Precautions, the minimum infection prevention practices that should be used for all patient care activities regardless of the suspected or confirmed infection status of the patient, include the use of PPE, such as gloves, gowns, masks.[3] For these reasons, medical gloves are the most common type of PPE used as a means of protection.[4]

Along with the rise in the use of medical gloves, increased reporting of latex allergies and other sensitivities continues to be a concern with perioperative staff members.[5] Healthcare workers often suffer from occupational skin diseases as the result of allergic sensitization; nurses are most often affected by hand eczema.[6]

Chemical exposure and skin disorders associated with the use of medical gloves can be inconvenient as well as costly; as we will discuss, they are also unnecessary and preventable.

THE DIFFERENCE BETWEEN LATEX ALLERGIES AND CHEMICAL ALLERGIES

Disposable medical gloves, especially powdered gloves, are the primary reservoir of latex allergens in healthcare delivery settings.[7] As a result, most allergy management programs concentrate on the understanding and treatment of latex protein allergy. However, in many cases, reactions to medical gloves often masquerade as chemical allergies to the various chemicals used in the manufacture of medical gloves; therefore, it is important to differentiate latex allergies and chemical allergies.

ALLERGIES

The three types of clinical reactions associated with medical glove products are[8] :

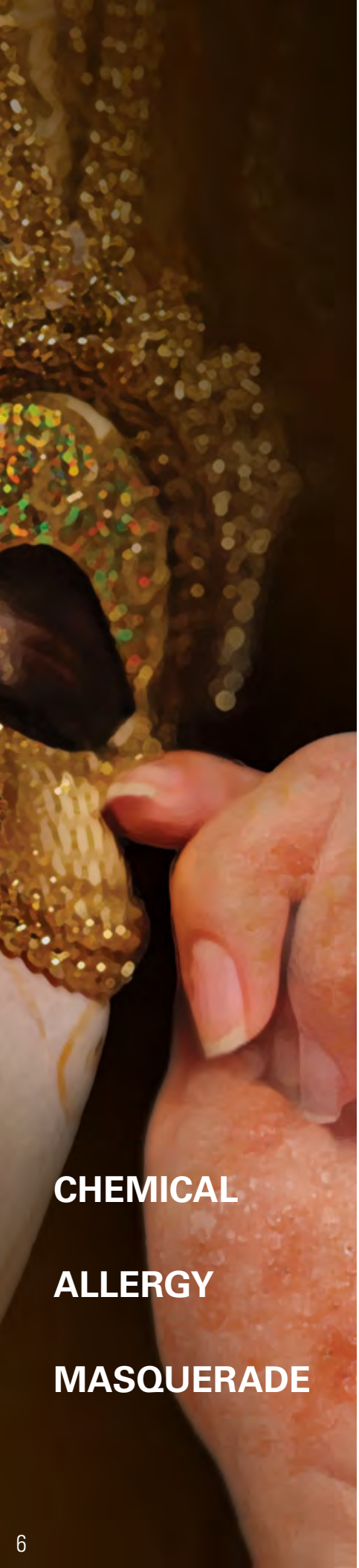
1. Type I IgE Mediated Allergic Reaction. This type of reaction is mediated by the allergic antibody IgE, which is directed against retained proteins in latex products; it is triggered by direct skin contact, mucosal surface contact, or inhalation. Symptoms include hives, angioedema, rhinitis, conjunctivitis, asthma, and anaphylaxis with or without death.

   This allergy may be life threatening and therefore, is the clinical problem that health care workers are most concerned about preventing. Natural rubber products can trigger the various reactions and symptoms noted above; in the case of disposable medical gloves, latex allergens that are adsorbed to glove-donning powders can lead to rhinoconjunctivitis and asthma.[9] Countries around the world are banning or restricting the use of powdered medical gloves to prevent such complications.

The two most important types of occupational contact dermatitis (OCD) are irritant contact dermatitis (ICD) and allergic contact dermatitis (ACD).

2. Irritant Contact Dermatitis (ICD). This is a non-allergic reaction generally seen in people who use rubber products frequently. It differs from contact dermatitis because it is not mediated by an immune system sensitization or reaction; instead, it is caused by frequent hand/skin washing, sweating, and/or irritation from powder lubricants due to persistent contact with the irritant. The typical symptoms include a pruritic rash with dry, erythematous, and/or fissured lesions. It is rarely associated with papules, vesiculation, or oozing of the skin and it does not extend beyond the point of contact with the causative irritant

3. Type IV Cell Mediated - Allergic Contact Dermatitis (ACD). This type of allergy is not life-threatening, but it is a major concern for health care workers. This reaction is usually limited to the area of the skin where contact with rubber products occurs. It is frequently a reaction to the various chemicals (primarily accelerators) that are used in the manufacture of medical gloves, which may be retained in the finished product. This contact dermatitis is a delayed-type immune reaction mediated by T-cell lymphocytes that occurs with exposure to these chemicals; it may take 24 to 48 hours from the time of exposure for the reaction to develop. Characteristic symptoms include a rash with erythema, papules, vesiculation, and oozing. Because the contact is usually repetitive, the rash may develop into a chronic problem and may even extend beyond the site of contact. It is important to note that this delayed-type contact allergy to chemicals may occur concurrently with IgE mediated allergic latex allergy. This reaction is also referred to as T-cell-mediated allergy, allergic contact dermatitis, or chemical allergy.



CHEMICAL ALLERGY MASQUERADE

CHEMICAL ALLERGIES

Today, chemical allergy, or allergic contact dermatitis, remains an even more important cause of disability and loss of work than latex allergy. A chemical allergy is an expansive allergic condition; combined with irritant contact dermatitis, these conditions represent the second largest occupational disability reported to US OSHA.[10]

In Australian workplaces, the development of occupational skin disease (OSD) Is the second most common work-related problem presenting to general practitioners in Australia (Hendrie & Driscoll 2003) and occupational contact dermatitis (OCD) is the most common OSD in westernized industrial countries – about 90-95% of all OSD (Lushniak 1995).

A survey of UK National Health Service (NHS) staff showed that 43% had signs or symptoms of irritant contact dermatitis or allergic contact dermatitis, and 10% showed latex hypersensitivity. (Johnson G., Time to take the gloves off?, Occupational Health (London), 1997; 49: 25-28)

In addition, allergic contact dermatitis brings a greater risk of bloodborne pathogen infection, because the body's most effective barrier – intact skin – becomes compromised. The breakdown of the dermis may also allow latex proteins to enter the body, which may facilitate latex protein hypersensitivity in some individuals.[11]

It is important to note that chemical allergy can occur from the use of both latex and non-latex medical gloves.

The remainder of this activity will focus on the problem of chemical allergies associated with the use of medical gloves.

INCIDENCE, CAUSES, AND SYMPTOMS OF CHEMICAL ALLERGY

INCIDENCE OF CHEMICAL ALLERGY

Among HCWs, medical gloves are one of the most frequent causes of chemical allergy.[12] The growing impact of chemical allergies is clear – of the total healthcare worker population, 33% of glove-related reactions are chemical allergies, while 17% are latex allergies,[13,14] thereby making chemical allergies a significant occupational hazard. The following statistics further highlight the growing concern of chemical allergy:

- Registers of occupational diseases are kept in several European and Asian countries and in the United States. Most of these registers include all skin diseases, and do not distinguish between ICD and ACD. Skin diseases constitute up to 30% of all notified occupational diseases; ICD and ACD account for about 90%-95% of this group

- Chemical exposure in the workplace has become a significant problem today; while the rates of most other occupational diseases are declining, the rates of skin disease are actually rising.[15]

USA

- Today, over 13 million US workers nationwide are potentially exposed to chemicals through the skin.[16]

- A retrospective analysis of one state's dermatitis-related workers' compensation claims, merged with U.S. census data, reported that the average cost per claim was $3,552, and the average disability time was 23.9 days.[17]

- Skin disorders are among the most frequently reported occupational illnesses and result in an estimated annual cost in the U.S. of over $1 billion.[18]

AUSTRALIA

- A review of 18 years of data from an occupational dermatology clinic in Australia found that 75 per cent of patients referred to the dermatology clinic had been diagnosed with occupational contact dermatitis

- Safe Work Australia (2012) released two research reports on occupational skin disease – the second most common work-related disease presented to general practitioners in Australia.
  - » Skin exposure to chemicals and the causes and occurrence of occupational skin disease are serious workplace health issues that have a large economic impact on the Australian economy each year.
  - » At a total economic cost of over $33 million dollars annually, occupational contact dermatitis is a preventable disease if the proper work health and safety systems are in place according to Safe Work Australia

UK

- 4 million working days are lost due to occupational skin disease and the UK Health & Safety Executive has calculated an associated cost to British industry of £200 million per year.

EUROPE

- According to the British Occupational Health Research Foundation, skin disease is the second commonest occupational disease in the European Union after musculoskeletal disorders.

- Occupational contact dermatitis (ICD and ACD) accounts for 70-90% of all occupational skin disease, while contact urticarial (latex allergy) accounts for less than 10%.

- The hands are most commonly affected by occupational contact dermatitis, and thereafter the wrists, forearms and face (Alanko 2004, Burnett 1998, Conde-Salazar 1995, Krajewska 1976, Lodi 2000, Mancuso 1990, Motolese 1993, Stingeni 1995, Suneja 2008, Tan 1997). Similar distributions have been observed for contact urticaria in a population where most cases were attributable to latex (Williams 2008).

- Occupational skin diseases account for 34% of all registered occupational diseases in Germany.

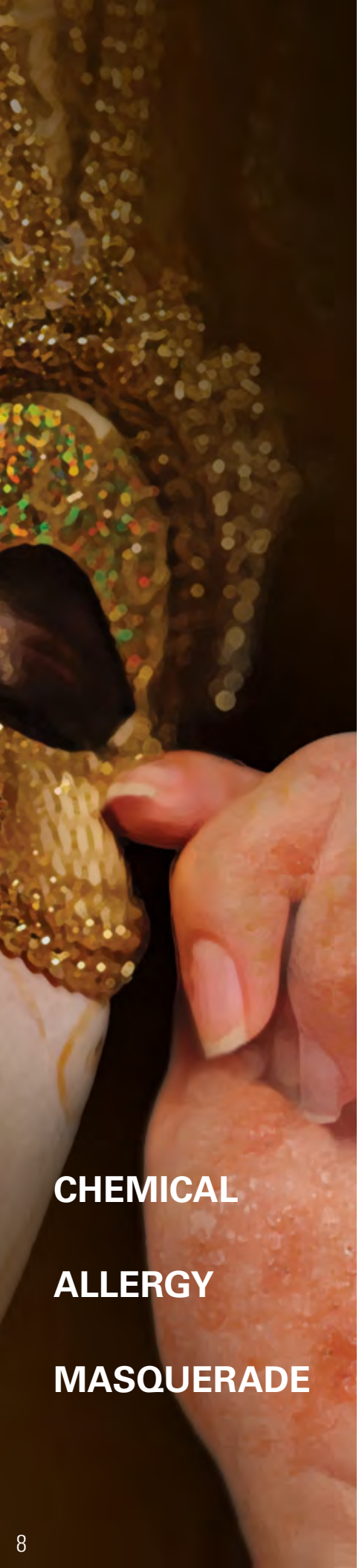
QUANTITATIVE RESEARCH

In regards to the prevalence and awareness of chemical allergies, quantitative research of perioperative registered nurses surveyed at the 2010 AORN 57th Congress demonstrated that[19] :

- 78.3% of the respondents said that they or someone at their facility had experienced hand irritation that was determined NOT to be a latex allergy;

- 52.7% of the respondents did not understand what a Type IV chemical allergy was; and

- 72.4% of those surveyed reported that they had issues with their hands being extra dry.



CHEMICAL ALLERGY MASQUERADE

CAUSES OF CHEMICAL ALLERGY

Chemical allergies to glove products are generally associated with the chemicals used in the glove manufacturing process.[20] Glove manufacturers use a variety of chemicals to produce both NRL and synthetic rubber gloves. Different manufacturers use different chemical combinations and nearly all manufacturers leach and wash their gloves to minimize residual chemicals in the final product. A chemical allergy is due to an immunological reaction to a residual chemical leached from finished glove products into the skin of the wearer.

The chemicals used in the glove manufacturing process fall into the following broad classifications:

- Accelerators;
- Accelerator activators;
- Stabilizers;
- Antidegradants;
- Retarders;
- Fillers; and
- Extenders.

The chemical accelerators induce the majority of chemical allergies. The residues from these accelerators have become a major concern because of their ability to sensitize users and elicit chemical allergic reactions. Over 80% of reported glove-associated allergic contact dermatitis is attributable to chemical accelerators.[21]

Without the use of chemical accelerators, many of the qualities that healthcare workers seek in NRL and most synthetic gloves (eg, barrier performance as demonstrated by tensile strength; elasticity) would not exist.[22] Chemical accelerators used in the manufacture of both NRL and synthetic medical gloves transform the original raw liquid state to a very thin, strong, elastic glove film; they also accelerate the bonding process of the gloving material during the manufacturing process. Accelerator chemicals help to tighten the glove matrix, improve and enhance barrier performance, and stabilize the raw gloving material. Sulfur is used to assist bonding of the glove material to form a product with superior stretch and recoil. Therefore, chemical accelerators are used to:

- Provide elasticity (stretch) to the glove;
- Allow cross-linking of the glove material to give strength to the glove;
- Give integrity to the glove material during use; and
- Stabilize the glove material for long term storage.

Accelerators play an important role in the crosslinking of rubber. They affect both the rate of cure and the length and number of crosslinks that form. Accelerators are frequently classified based on the characteristics below:

Accelerator Comparison

Accelerator Type	Cure Rate	Crosslink Length
Diphenylguanidine (DPG)	moderate	medium -long
Mercaptobenzothiazoles (MBTs)	moderate	medium
Thiurams	very fast	short
Dithiocarbamates	very fast	short

R.T. Vanderbuilt Company Inc Norwalk, CT

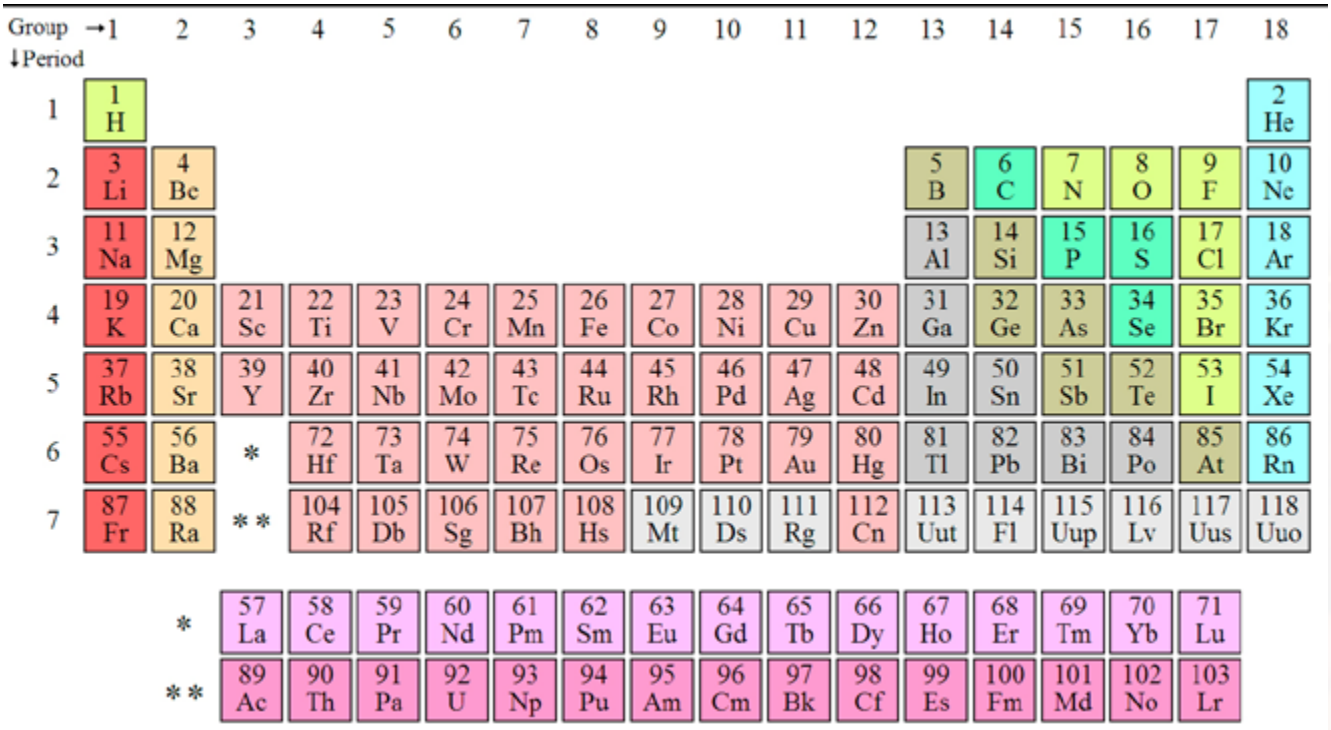
There are four main classes of chemical accelerators that are generally used in the manufacture of medical gloves, either individually or in combination, that induce the majority of skin dermatitis reactions, as described below.[23]

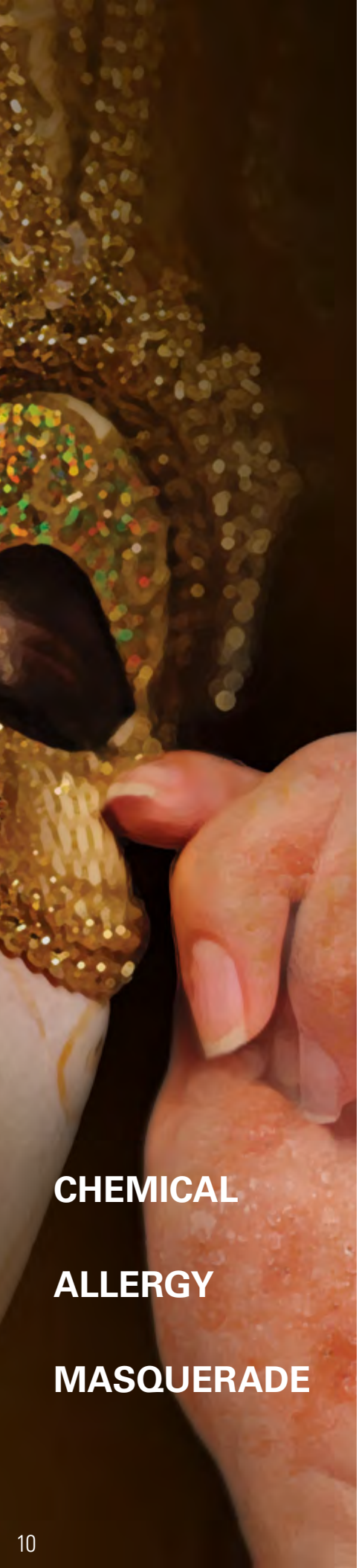
1. Thiurams. The universal vulcanizing agent for rubber is sulfur, but sulfur donors, such as thiurams, are often more efficient. Thiurams decompose during vulcanization, liberating the sulfur and carbamates (dithiocarbamates). Formulations containing thiurams allow manufacturers to produce gloves at higher outputs, thus reducing the overall cost of the gloves. Thiurams are most commonly regarded as the primary cause of chemical allergy. Thiurams account for 60% of accelerator-related skin irritation.

2. Dithiocarbamates/Carbamates. Dithiocarbamates absorb sulfur and carry it into the glove material to facilitate cross-linking and curing. There are more than 34 types of these compounds. They contain zinc, which is important to the solubility of the accelerator in natural rubber and synthetic rubber, and its ability to react with sulfur. Dithiocarbamates account for 30% of accelerator-related skin irritation.

3. Mercaptobenzothiazoles (MBTs). MBTs react well with zinc, assisting with the cross-linking of the sulfur bonds and adding tensile strength to the glove. The incidence of sensitization to this group of compounds is lower than other accelerator compounds, as they account for between 1% to 5% of accelerator-related skin irritation.

4. Diphenylguanidine (DPG). DPG is one of the common accelerators for the vulcanization of rubber in combination with thiazoles and sulfonamides. Though it does not show better activity then thiurams and dithiocarbeamates, it has better stability. In a study reported in Contact Dermatitis, February 2013, contact allergy to thiuram mix was found in 8 of 16 patients, whereas 12 of 16 patients reacted to DPG. Over the past several years, rumors have continued to swirl that guanidine accelerators, specifically diphenylguanidine (DPG) and N,N'-di-ortho-tolylguanidine (DOTG), may no longer be allowed to be sold in Europe due to prospective REACh regulations.





CHEMICAL ALLERGY MASQUERADE

Additional factors that contribute to dermatitis cases include:

- Pre-existing irritant allergic contact dermatitis. Occupational contact dermatitis accounts for between 70% and 90% of all reported cases of occupational skin disease.[24] Irritant allergic contact dermatitis is caused by a number of factors such as frequent hand washing, aggressive scrubbing techniques, and inadequate hand drying.

- A combination of factors such as the cumulative effect of repeated exposure; hydration resulting from perspiration; the variation in the amount of residual chemicals within the same product type; and enhanced skin penetration may also be significant contributors to sensitization.[25]

- Some people may also be sensitive to other substances that are associated with medical gloves, such as [26]:
  - » Lanolin, which is used by some manufacturers as a glove softener;
  - » Polyoxypropyleneglycol, a coagulant also used in glove manufacturing;
  - » Coloring pigments, which may be either organic or inorganic;
  - » Quaternary ammonium compounds;
  - » Antioxidants used to prevent the degradation of NRL products; and
  - » Preservatives.

SYMPTOMS OF CHEMICAL ALLERGY

The symptoms of a chemical allergy (ACD) begin when the chemical involved penetrates the skin, resulting in vesiculation, erythema, swelling, cracking, and itching of the skin at the site of contact (see Figure 1). This dermatitis frequently extends beyond this area of contact (eg, the forearm in a HCW wearing a glove).

Figure 1 – Symptoms of a Chemical Allergy

Figure 2 – Skin Dermatitis Reactions

The response is delayed rather than immediate (ie, a Type IV delayed reaction); symptoms usually appear within 6 to 48 hours after the initial contact, although symptoms can last up to 4 days. Continued exposure may lead to chronic ACD manifested as dry, irritated, cracked, pruritic skin with erythema (see Figure 2). ACD (a chemical allergy) is more common than latex protein allergy. In addition, ACD may play a role in latex sensitization, since it reduces the barrier properties of the skin and thus allows absorption of larger amounts of chemicals or proteins; this is thought to increase the risk of latex sensitization.[27] An increased frequency and progression through ACD may precede the onset of latex allergy.[28]

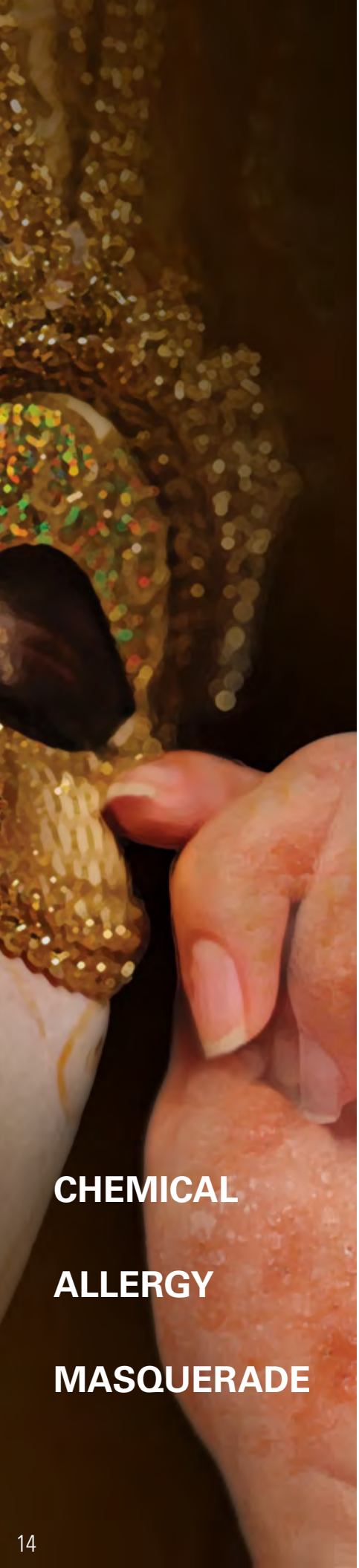
TREATMENT OPTIONS FOR CHEMICAL ALLERGY

Chemical allergies and other adverse glove reactions in HCWs and patients can be managed by understanding and recognizing them and then taking appropriate action. HCWs should be encouraged to report any symptoms. Individuals experiencing recurrent or persistent dermatitis should consult with their doctor or an allergist or dermatologist in order to establish a specific diagnosis.

A diagnosis is made on the basis of a detailed medical history, physical exam, and the relevance of positive patch tests with offending glove chemicals.[29,30] Comprehensive patch testing should only be performed by physicians who have extensive training, interest, knowledge, and expertise in ACD and patch testing.[31] In comprehensive patch testing, the patient is tested with a large number of allergens, usually between 65 and 200. The specific allergens used and the number of allergens tested are tailored to each person, based on his/her medical history, findings on examination, and environmental exposure history. Comprehensive patch testing has repeatedly demonstrated a much higher probability of yielding a diagnosis of a specific allergy for an individual, in contrast to limited patch testing, thereby resulting in a much higher probability of a cure.

A preferred treatment option is the short-term use of potent topical corticosteroids to control the symptoms; nonsteroidal topical immunomodulators, such as tacrolimus or pimecrolimus, can also be beneficial.[32] Very severe cases of ACD may require a short course of oral corticosteroids and immunosuppressive therapy, such as cyclosporine.

ACD is one of the only types of dermatitis that is completely curable; this means that if specific allergens are identified and appropriate strategies are implemented for allergen avoidance, many individuals will no longer require physician visits and prescriptions.[33] Therefore, most healthcare personnel who have ACD can return to work.



CHEMICAL ALLERGY MASQUERADE

STRATEGIES TO REDUCE CHEMICAL ALLERGY RISK

There are several strategies that healthcare personnel can take to help reduce the risk of irritant contact dermatitis (ICD) and allergic contact dermatitis (ACD) caused by glove use; these include, but are not limited to[34]:

- Being tested to determine the chemicals to which they are susceptible. This is an important step and one that should not be put off.
- Minimizing or eliminating contact with the causative agent.
  - » Powder-free gloves are recommended over powdered gloves in general.
  - » Latex-allergic individuals should switch to latex-free gloves; it is also suggested that coworkers of latex-allergic persons should use powder-free latex gloves or latex-free gloves to prevent aeroallergen transmission.
  - » Chemical-allergic individuals should use gloves that do not contain the causative agent or gloves that have demonstrated a reduced potential for reaction in individuals sensitized to the causative agent.
  - » Gloves that are manufactured without the causative agent or accelerator, ie, not all accelerators are used in the manufacturing of medical gloves, should be selected.
- Instituting a regular skin care regimen to keep hands healthy, since healthy skin is the first line of defense against infection.
- Asking facility administration about education programs to help them understand the causes and solutions to allergies and skin conditions related to their occupation.

Unfortunately, the use of non-latex gloves will not prevent chemical allergies, because chemical accelerators are generally used in the manufacturing of synthetic (ie, non-latex) as well as latex gloves. In the research conducted at the 2010 AORN 57th Congress noted above, 53.9% of 954 respondents indicated that staff members continued to experience allergy issues, even when they switched to non-latex gloves.[35]

HOW TO SELECT AND USE ALTERNATIVE MEDICAL GLOVE PRODUCTS SAFELY IN THE WORKPLACE TO MINIMIZE/ PREVENT CHEMICAL ALLERGY

With the heightened awareness of allergy issues related to the use of gloves, several types of alternative medical glove products are available to the end user to reduce the risk of chemical allergy and improve safety. Each of these types of gloves offers unique advantages, but at the same time, each has certain properties unique to the gloving materials. No single glove provides the perfect solution for all clinical applications; therefore, it is nearly impossible for a health care facility to standardize on a single type of glove material without encountering difficulties.

MEDICAL GLOVE OPTIONS

The types of medical gloves available today are briefly described below. Table 1 provides a summary of the key characteristics, with a focus on allergen content, of the various glove types.

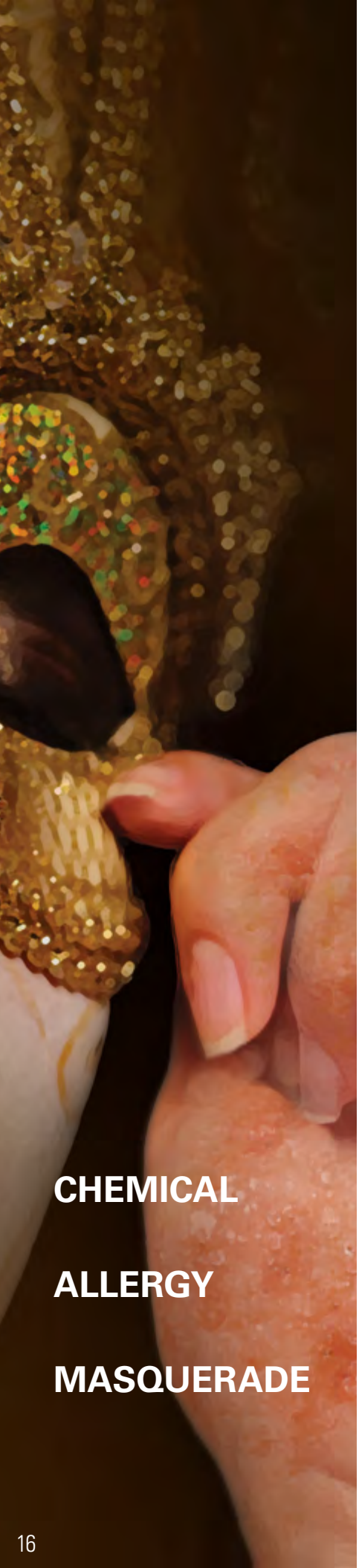
- **Latex** has long been the benchmark standard for fit, feel, comfort, strength, and barrier protection. Latex gloves are available as an examination glove or sterile surgical glove.

- **Neoprene** has been a popular latex alternative in the OR and more recently as an examination glove because it is one of the most "latex-like" synthetic glove films. It offers superior comfort, but is more expensive than latex. Neoprene gloves are also available as sterile surgical glove.

- **Nitrile** has become more popular in recent years because it offers excellent tear and chemical resistance; however, it costs more than other glove materials such as vinyl. Nitrile gloves are available as either sterile or non-sterile examination gloves.

- **Polyisoprene** is the new alternative to latex. It has both a fit and feel that are very close to latex. Polyisoprene gloves are available only as sterile surgical gloves.

- **Vinyl** [Polyvinyl chloride (PVC)]. Vinyl is an economical alternative to latex; however, it is associated with reduced barrier protection due to its susceptibility to tears, breakage, and pinholes. Vinyl gloves are available only as an examination gloves.



CHEMICAL

ALLERGY

MASQUERADE

ALLERGEN CONTENT AND OTHER KEY CHARACTERISTICS BY GLOVE TYPE

Table 1

Glove Type	Allergen Content	Level of Barrier Protection	Strength and Durability	Elasticity	Puncture Resistance	Fit and Comfort
Latex	**Varies** Latex contains protein and chemical allergens Powder-free gloves are lower in allergens than powdered gloves	**Excellent** The long-standing benchmark for barrier protection due to its strength and elasticity	**Excellent** Natural rubber latex is very strong and durable Tensile strength is typically 3000 pounds per square inch (psi) or better	**Excellent** Latex elasticity is superior to the other glove films currently available Memory is very high allowing the film to always return to its original shape Elongation limit is about 750%	**Very Good** Latex is very resistant to punctures but can be pierced by very sharp objects	**Excellent** Latex provides excellent comfort and fit due to its high elasticity and memory
Neoprene	**Excellent** Neoprene contains no latex proteins, but does contain a low level of chemical allergens	**Very Good** Neoprene provides barrier protection similar to that of latex	**Very Good** Unbroken neoprene is strong; however, once punctured, the film tends to tear easily Tensile strength is typically 3000 psi or better	**Excellent** Neoprene elasticity is close to that of latex and memory is very high, allowing the film to retain its original shape Elongation limit is about 750%	**Good** Neoprene is somewhat puncture resistant	**Excellent** Neoprene provides excellent comfort and fit due to its high elasticity and memory
Nitrile	**Very Good** Nitrile contains no latex proteins, but does contain some curing agents	**Excellent** Nitrile film is highly resistant to punctures and tears	**Excellent** Nitrile film is extremely strong with puncture resistance superior to all glove films Tensile strength is typically well above 3000.	**Very Good** Nitrile elasticity is very good with elongation limits typically 500% or better Nitrile exhibits some memory, allowing the film to adapt to the wearer's hand	**Excellent** Puncture resistance is superior to all other medical glove films currently available	**Very Good** Nitrile provides very good comfort and fit due to its high elasticity and memory Because of its slightly tighter fit, users often choose a larger size
Polyisoprene	**Very Good** Polyisoprene contains no latex proteins, but does contains some curing agents	**Fair** Polyisoprene provides a good barrier protection, but is more permeable than latex It is resistant to punctures	**Very Good** Polyisoprene is durable Tensile strength is typically 2500 psi or better	**Excellent** Polyisoprene elasticity is similar to natural rubber	**Good** Polyisoprene is somewhat puncture resistant	**Very Good** Polyisoprene provides very good comfort and fit due to similar properties to natural rubber latex, but slightly stiffer
Vinyl (PVC)	**Very Good** Vinyl contains no natural rubber proteins and no chemical curing agents	**Poor** Vinyl breaks and punctures easily during use The fit around the wrist is baggy, making it a poor barrier	**Poor** Vinyl is the weakest of the glove films and tends to break and puncture easily when stressed Tensile strength is typically below 2000 psi	**Fair to Poor** Vinyl elasticity is limited and varies from brand to brand Typical elongation limit is less than 500% The film exhibits limited memory	**Poor** Vinyl is easily punctured by sharp objects	**Fair** Low elasticity limits fit and comfort for many users The wrist diameter is usually very large making the glove baggy around the cuff

ADVANCES IN GLOVE TECHNOLOGY: ACCELERATOR-FREE GLOVES

Today, in response to the growing interest in allergic contact dermatitis, new technologies have led to the development of accelerator-free gloves; these gloves are the latest innovation in the ongoing effort by glove manufacturers to provide effective barrier protection without causing allergic reactions.[36,37] As noted above, since the majority (over 80%) of reported glove-associated allergic contact dermatitis is attributable to chemical accelerators, the removal of accelerators from gloves does offer the potential for helping to decrease the prevalence of allergic contact dermatitis.[38]

A wide range of gloves are available that provide non-latex, accelerator-free (ie, they do not contain any sulfur-based accelerators such as thiurams, carbamates, thiazoles, guanidine, or thioureas) options which are easy to use and offer the protection and safety for any allergy profile and surgical need.

Some manufacturers have added a moisturizer on the internal surface of medical gloves. The moisturizer is in direct contact with the skin and penetrates into the hands to help repair damaged skin and provide protection against drying and cracking of the skin.

In regards to the use of these types of gloves, 72.5% of the perioperative registered nurses surveyed at the 2010 AORN 57th Congress responded that their facility does not use gloves that have the ability to moisturize hands.[39]

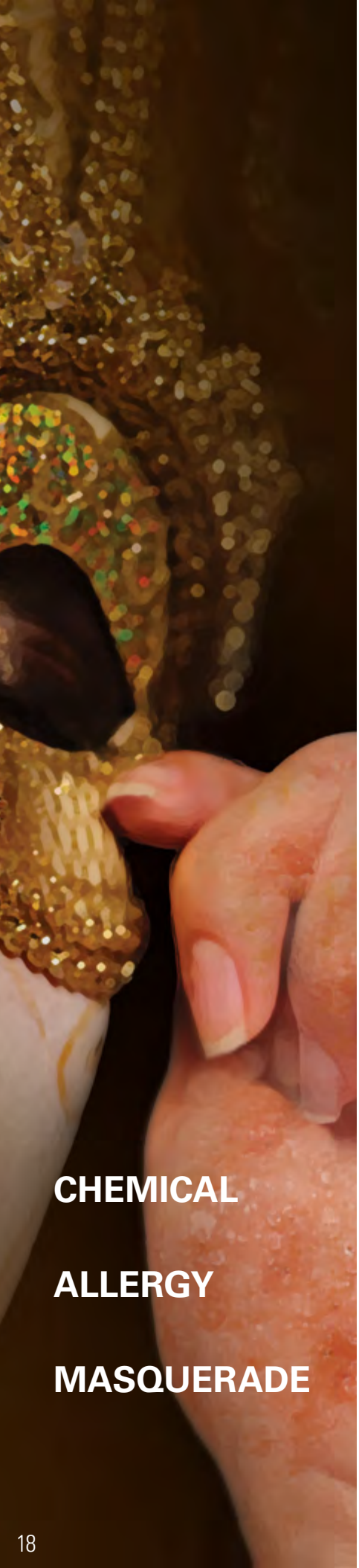
Additional clinical benefits of non-latex, accelerator-free gloves include that they:

- Provide excellent sensitivity while maintaining strength;
- Ensure comprehensive protection for health care workers with chemical allergies to accelerators; and
- Provide the desirable fit and expected donning properties and grip.

RECOMMENDED PRACTICES FOR PRODUCT SELECTION IN PERIOPERATIVE PRACTICE SETTINGS[40]

As with all products used in the perioperative practice setting, a mechanism for product selection should be developed; this includes establishing a multidisciplinary product evaluation and selection committee to develop a standardized product selection process. The committee should be obtaining information on new or existing products from either professional resources or manufacturers. Manufacturers' representatives have access to information about products that are currently available; in addition, they can provide both technical and clinical data related to their products. A product-specific evaluation tool, using unique, product-specific requirements and criteria, should also be developed and implemented.

- Examples of product-specific requirements include, but are not limited to:
  - » Contractual agreements;
  - » Procedure-related requirements;
  - » End-user preferences and requirements (eg, comfort, the amount of protection from blood and body fluids, size, free from toxic ingredients or allergens);
  - » Patient-related requirements (eg, presence of infectious diseases);
  - » Compliance with federal, state, and local regulatory agencies; and
  - » Compliance with standard-setting bodies.
- Examples of product-specific criteria include, but are not limited to:
  - » Safety;
  - » Performance;
  - » Quality;
  - » Ease of use;
  - » Efficiency;
  - » Impact on quality patient care and clinical outcomes;
  - » Evidence-based efficacy;
  - » Financial impact;
  - » Environmental impact; and
  - » Availability and quality of service after the purchase.



CHEMICAL ALLERGY MASQUERADE

REVIEW

Protecting HCWs and patients from transmission of potentially infectious agents is a primary goal for all members of the healthcare team; the appropriate selection and use of PPE are key practices in achieving this goal. Medical gloves are the most common type of PPE used as a means of protection by health care workers in complying with the OSHA Bloodborne Pathogen Standard and implementing Standard Precautions. The frequent use of gloves has resulted in an increase in reports related to several glove-related issues – particularly allergies and other sensitivities – which continue to be a concern among healthcare providers and perioperative staff members.

Today, the growing impact of chemical allergies as an occupational hazard among HCWs is clear, considering that 33% of glove-related reactions are chemical allergies, whereas 17% are latex allergies. Chemical allergies may compromise intact skin and therefore, predispose some individuals to an even greater risk of bloodborne pathogen infection. Skin breakdown can also permit the passage of latex proteins into the body, thereby facilitating latex protein hypersensitivity in some individuals. Chemical allergies to glove products are generally associated with the accelerators that are used in the manufacturing process to give gloves many of the qualities that HCWs desire.

Chemical exposure and the resultant skin disorders can be inconvenient as well as costly; fortunately, they are also unnecessary and can be preventable. Today, in response to the growing interest in allergic contact dermatitis, new technologies have led to the development of accelerator-free gloves. These gloves are the latest innovation in the ongoing effort by glove manufacturers to provide effective barrier protection without causing allergic reactions. Through understanding the clinical implications of chemical allergies related to glove use, nurses can select and use glove products that promote the highest degree of safety and efficacy for their patients and members of the surgical team.

The majority of costs associated with allergic contact dermatitis (chemical allergy/Type IV) allergies are preventable and solutions are available, reasonable, and accommodating! Employers can provide superior medical and surgical gloves that are accelerator-free.

GLOSSARY

ACCELERATORS
Chemicals used in the manufacture of both latex and synthetic medical gloves to transform the original raw liquid state to a very thin, strong, elastic glove film. These chemicals accelerate the bonding process of the gloving material during the manufacturing process; help to tighten the glove matrix; improve and enhance barrier performance; and stabilize the raw gloving material. The accelerator group chemicals induce the majority of the skin dermatitis reactions.

ALLERGIC CONTACT DERMATITIS
A delayed hypersensitivity response attributed to chemicals used in the latex and some synthetic manufacturing processes and absorbed through the skin; this reaction is usually localized to the contact area.

ALLERGEN
An antigen that can produce a hypersensitivity reaction in the body.

ALLERGY
An acquired, abnormal immune reaction to an environmental agent that results in a symptomatic reaction.

BLOODBORNE PATHOGENS
Pathogenic microorganisms that are present in human blood and can cause disease in humans. These pathogens include, but are not limited to, hepatitis B virus (HBV) and human immunodeficiency virus (HIV).

CHEMICAL ALLERGY
An expansive allergic condition due to an immunological reaction to a residual chemical leached from finished glove products.

IRRITANT CONTACT DERMATITIS
The development of dry, itchy, irritated areas on the skin, usually the hands. This type of reaction is not an actual allergy to latex, but is the irritation from frequent glove use and also from hand/skin washing, sweating, and/or irritation from powder lubricants due to persistent contact with the irritant

LATEX ALLERGY
A localized or systemic allergic response to one or more specific proteins found in latex to which an individual has been sensitized and has developed antibodies; a type I hypersensitivity reaction.

NATURAL LATEX
The milky fluid that consists of extremely small particles of rubber obtained from the rubber tree (Hevea brasiliensis). It contains a variety of substances and plant proteins thought to be primary allergens.

NATURAL RUBBER LATEX (NRL)
This term includes all materials made from or containing natural latex.

OCCUPATIONAL EXPOSURE
Reasonably anticipated skin, eye, mucous membrane, or parenteral contact with blood or other potentially infectious materials that may result from the performance of an employee's duties. Other Potentially Infectious Material Blood; all body fluids, secretions, and excretions (except sweat), regardless of whether they contain visible blood; nonintact skin; mucous membranes; and airborne, droplet, and contact-transmitted epidemiologically important pathogens.

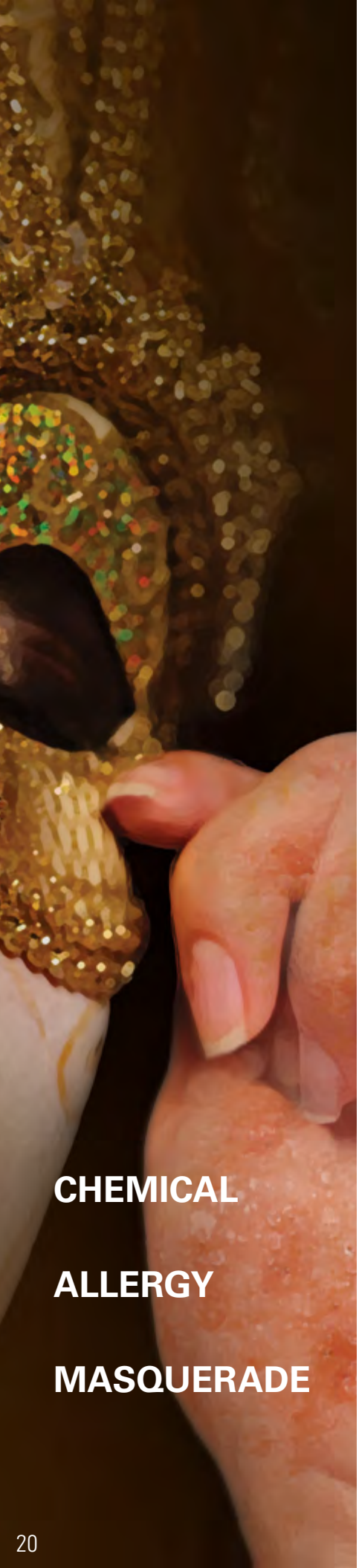
PATHOGEN
A microorganism that causes disease.

PERSONAL PROTECTIVE EQUIPMENT (PPE)
Specialized clothing or equipment for the eyes, face, head, body, and extremities worn by an employee for protection against injury or exposure to a patient's blood, tissue, or body fluids; examples of PPE are gloves, gowns, face, and eye protection.

STANDARD PRECAUTIONS
The primary strategy for successful infection control and reduction of health care worker exposure. Standard precautions are used for care of all patients, regardless of their diagnosis or presumed infectious status.

TYPE I IgE MEDIATED ALLERGIC REACTION
A reaction is mediated by the allergic antibody IgE, directed against retained proteins in latex products; it is triggered by direct skin contact, mucosal surface contact, or inhalation. This allergy may be life threatening and is the most concerning problem for health care workers.

TYPE IV CELL MEDIATED CONTACT DERMATITIS
A non-life threatening reaction that is usually limited to the area of the skin where contact with rubber products occurs; it is frequently a reaction to the various chemicals (primarily accelerators) that are used in the manufacture of medical gloves and retained in the finished product. The reaction may develop within 24 to 48 hours from the time of exposure.



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