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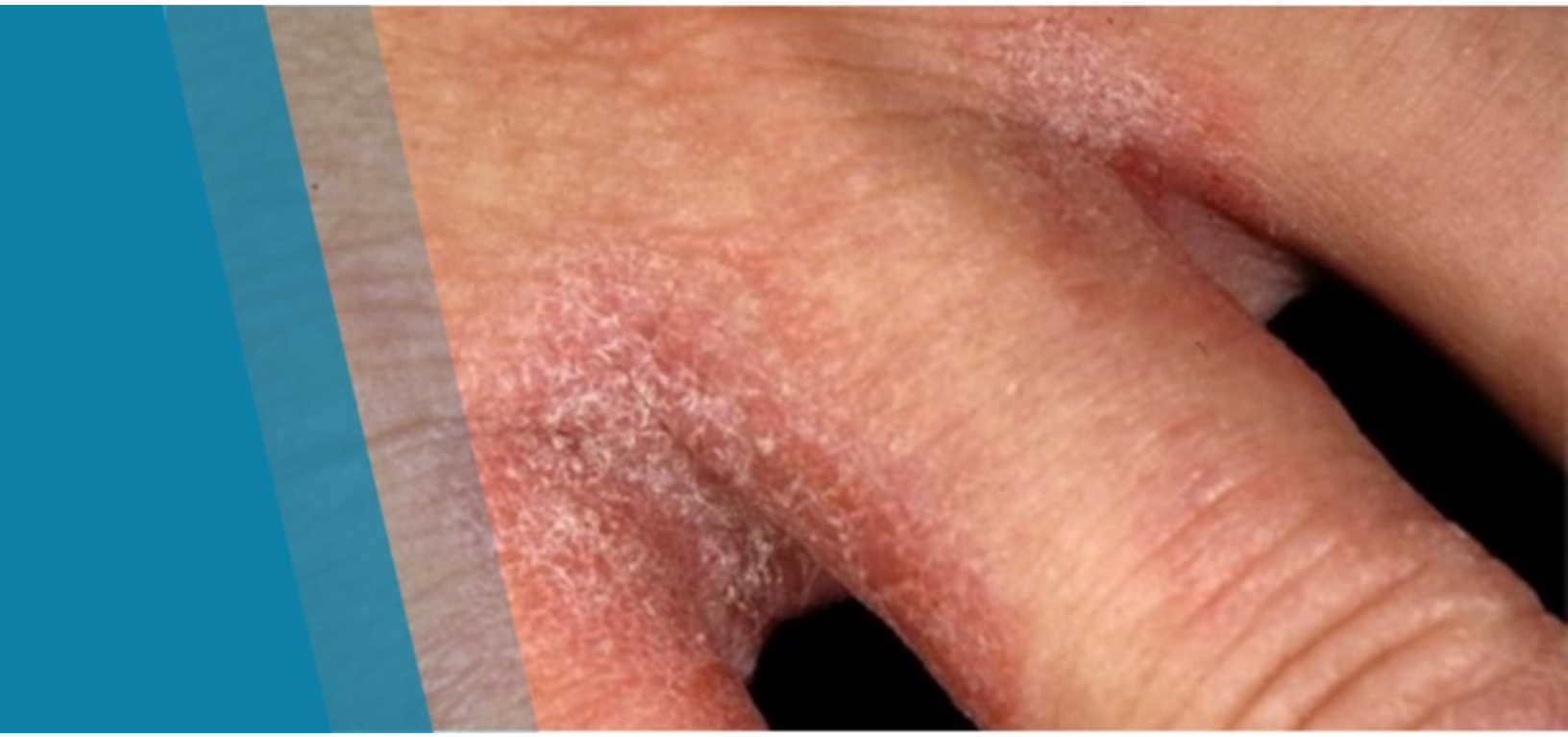
Recommendations for the Prevention, Detection and Management of Occupational Contact Dermatitis in Health Care Settings



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Public Health Ontario

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Glossary of Terms

Additional Precautions: Precautions (i.e., Contact Precautions, Droplet Precautions and Airborne Precautions) that are necessary in addition to Routine Practices for certain pathogens or clinical presentations. These precautions are based on the method of transmission (e.g., contact, droplet, airborne). See also Routine Practices.

Alcohol-based hand rub (ABHR): A liquid, gel or foam formulation of alcohol (e.g., ethanol), which is used to reduce the number of microorganisms on hands in clinical situations when the hands are not visibly soiled. ABHR may contain emollients to reduce skin irritation and is less time-consuming to use than washing with soap and water.

Allergic contact dermatitis: Occurs when a substance triggers an immune response in the skin. Nickel, fragrances, dyes, rubber products, topical medications and cosmetics frequently cause allergic contact dermatitis.[1]

Atopy: Refers to the genetic tendency to develop allergic diseases, such as allergic rhinitis, asthma and atopic dermatitis. Atopy is typically associated with heightened immune responses to common allergens, especially inhaled and food allergens.[2]

Atopic dermatitis: A chronic inflammatory skin disease that is characterized by intense itching and recurrent eczematous lesions. Although it most often starts in infancy, it is also highly prevalent in adults.[2] (Also known as atopic eczema.)

Barrier creams: Place a barrier between the skin and irritating substances to inhibit or delay penetration and are typically used in industrial settings. (Also known as prework creams, skin protective creams, antisolvent gels, protective ointments, shielding lotions or invisible gloves.)

Chain of Transmission: A model used to understand the infection process. (Also known as Chain of Infection.)

Colonization: The presence and growth of a microorganism in or on a body with growth and multiplication, but without tissue invasion or cellular injury or symptoms.

Contact dermatitis: An inflammation of the skin resulting from direct contact of a substance with the surface of the skin. Symptoms of contact dermatitis include itchy, painful or burning skin that can appear as a red rash, bumps or blisters, and draining fluid. The two main types are allergic contact dermatitis and irritant contact dermatitis.[1]

Dermatitis: An inflammation of the skin resulting from a variety of causes.[3]

Dermatosis: (plural: dermatoses) A broad term that refers to any disease of the skin, whether or not it is accompanied by inflammation. This should not be confused with dermatitis, which is limited to inflammation of the skin.[4]

Eczema: The most common of the inflammatory dermatoses, comprising a group of skin disorders that exhibit a common pattern of histological and clinical findings, which vary depending on the stage of the disease. The terms eczema and dermatitis are often used interchangeably. Clinically, primary lesions are macules, papules and vesicles. Secondary lesions include oozing, crusting, scaling, lichenification, hyperkeratosis and fissuring. Pruritus is common in all types of eczema/dermatitis.[3]

Emollients: Noncosmetic moisturizers which help to soften and soothe the skin. They come in the form of creams, ointments, lotions and gels. They keep the skin moist and flexible, helping to prevent cracks. Emollient hand lotions are the most common product in health care settings.[5]

Excipients: Ingredients in medicines other than the active drug that are essential for their manufacture, stability and function. These ingredients should be inert; however, they do have the potential to cause adverse effects in sensitive individuals.[6]

Filaggrin: A structural protein that is fundamental in the development and maintenance of the skin barrier. Mutations in the filaggrin gene result in reduced production of filaggrin, which has been shown to be a risk factor for dermatitis.[7]

Hand care program: A key component of hand hygiene for health care workers that incorporates hand care assessment (including skin screening and skin health surveillance), education and training, provision of emollient hand lotions or creams, and provision of ABHR that contains emollients.

Hand hygiene: A general term referring to any action of hand cleaning. Hand hygiene relates to the removal of visible soil and removal or killing of transient microorganisms from the hands. Hand hygiene may be accomplished using ABHR or soap and running water. Hand hygiene includes surgical hand antisepsis.

Hand washing: The physical removal of microorganisms from the hands using soap (plain or antimicrobial) and running water.

Hapten: A small molecule that elicits an immune response when bound to a carrier protein. Haptens have been used to boost immune responses to antigens; test for allergic contact dermatitis and inflammatory bowel disease; and induce autoimmune responses, viral wart regression and antitumor immunity.[8]

Health care setting: Any location where health care is provided, including settings where emergency care is provided, hospitals, complex continuing care, rehabilitation hospitals, long-term care homes, mental health facilities, outpatient clinics, community health centres and clinics, physician offices, dental offices, independent health facilities, out-of-hospital premises, offices of other health professionals, public health clinics and home health care.

Health care–associated infection: An infection that is acquired by a patient during the delivery of health care. (Also known as nosocomial infection.)

Health care worker (HCW): Any person carrying on activities in a health care setting, including, but not limited to, employees, physicians, nurses, dental professionals, allied health professionals, pre-hospital care workers, contract workers, students, post-graduate medical trainees, researchers, home health care workers and volunteers.[9]

Humectants: Bond with water molecules to increase water absorption from the dermis and from the atmosphere in humid conditions, penetrating the stratum corneum and retaining water in the epidermis.

Hyperhidrosis: Excessive sweating.

Infection: The entry and multiplication of an infectious agent in the tissues of the host. Asymptomatic or subclinical infection is an infectious process running a course similar to that of clinical disease, but below the threshold of clinical symptoms. Symptomatic or clinical infection is one resulting in clinical signs and symptoms (disease).

Infection prevention and control (IPAC): Evidence-based practices and procedures that, when applied consistently in health care settings, can prevent or reduce the risk of transmission of microorganisms to health care workers, patients and visitors and the development of health care–associated infections in patients from their own microorganisms.

Infection Prevention and Control Professional (IPC): Trained individual responsible for infection prevention and control activities in health care settings. These activities may include development, implementation and evaluation of educational programs, policies and procedures, and practices that will impact the prevention of infections. Specific functions and competencies may vary depending on the setting. For additional information related to the role and required competencies of an IPC, refer to Infection Prevention and Control-Canada.[10]

Infectious agent: A microorganism, i.e., a bacterium, fungus, parasite or virus, which is capable of invading body tissues and multiplying.

Irritant contact dermatitis: The most common form of contact dermatitis caused when substances, such as solvents or other chemicals irritate the skin. The exposure produces red, often more painful than itchy, patches on the involved skin areas.[1] In health care settings, wet work is a common cause of irritant contact dermatitis.

Natural moisturizing factor: Substance composed of free amino acids and amino acid derivatives. It is a highly efficient humectant that attracts and binds water from the atmosphere drawing it into the corneocytes in the stratum corneum. It also helps acidify the stratum corneum, which is integral to the barrier function of the skin.[11]

Occlusives: Form an inert layer (e.g., layer of oil) on the skin to physically block transepidermal water loss.

Occupational contact dermatitis: Contact dermatitis is an inflammation of the skin that results from direct contact of a substance with the surface of the skin. The term occupational contact dermatitis is used when this contact or exposure occurs in the workplace.

Occupational contact urticaria: The development of a wheal-and-flare reaction at a site where an external agent contacts the skin, in the context of a work setting. Nonimmunological occupational contact urticaria, the most common type, is an immediate reaction not requiring prior allergen exposure; while immunological occupational contact urticaria is a type I, immunoglobulin E–mediated hypersensitivity reaction in which the patient's immune system has been previously sensitized to the eliciting allergen (e.g., latex).[12] Occupational contact urticaria appears as red, itchy, swollen wheals or hives on the skin that range in size and appear anywhere on the body.[13]

Occupational health and safety: In a health care context, preventive and therapeutic health services in the workplace provided by trained occupational health professionals (e.g., nurses, hygienists, physicians).

Ontario Agency for Health Protection and Promotion: A Crown corporation dedicated to protecting and promoting the health of all Ontarians and reducing inequities in health. The Ontario Agency for Health Protection and Promotion began operations in 2008 following the passing of its founding legislation, the *Ontario Agency for Health Protection and Promotion Act*, in 2007. The Ontario Agency for Health Protection and Promotion has been operating under the name Public Health Ontario (PHO) since 2011. See also Public Health Ontario.

Patient: An individual receiving health care services. This term used throughout the document is inclusive of clients and residents.

Personal protective equipment: Clothing or equipment worn for protection against hazards.

Primary prevention: Prevention of disease or injury before it ever occurs. This is done by preventing exposures to hazards that cause disease or injury, altering unhealthy or unsafe behaviours that can lead to disease or injury and increasing resistance to disease or injury should exposure occur.[14]

Provincial Infectious Diseases Advisory Committee (PIDAC): A multidisciplinary scientific advisory body of Public Health Ontario that provides evidence-based advice regarding multiple aspects of infectious disease identification, prevention and control.

Public Health Agency of Canada (PHAC): A national agency of Canada that promotes improvement in the health status of Canadians through public health, emergency preparedness and response and infectious and chronic disease control and prevention.

Public Health Ontario (PHO): The operating name for the Ontario Agency for Health Protection and Promotion since 2011. PHO provides scientific and technical advice and support to clients working in government, public health, health care and related sectors, with a mission to enable informed decisions and actions that protect and promote health and contribute to reducing health inequities. See also Ontario Agency for Health Protection and Promotion.

Redeployment: The reassignment of employees to other departments or jobs within the organization as an alternative to layoff when a job can no longer be accommodated for the health and safety of the individual. See also workplace modifications.

Regional IPAC Support Team: Consists of five Regional IPAC Offices (and two satellite offices) that work with health care professionals across Ontario to support the adoption of IPAC best practices in their settings. The Regional IPAC Offices provide extensive consultation and education services and maintain stakeholder relationships at the local level and across Ontario. (Formerly **Regional Infection Control Networks.**)

Routine Practices: The system of infection prevention and control practices, recommended by both Public Health Agency of Canada and Public Health Ontario, to be used by health care workers with all patients during all care to prevent and control transmission of microorganisms in all health care settings. See also Additional Precautions.

Screening: A process to identify health care workers at risk for occupational contact dermatitis through administration of a questionnaire and/or medical examination, in order to detect dermatitis at a point when intervention would be beneficial. Positive screening tests may indicate the presence of occupational contact dermatitis or the strong likelihood of occupational contact dermatitis and the need for further assessment. Screening is designed to detect disease before an individual would normally seek medical care; it should ideally detect disease in its pre-clinical stage. The goal of medical screening should be the secondary prevention of disease, i.e., the identification of disease at a stage when its progression can be reversed, arrested or slowed.[15]

Secondary prevention: Reduction of the impact of a disease or injury that has already occurred. This is done by detecting and treating disease or injury as soon as possible to halt or slow its progress, encouraging personal strategies to prevent reinjury or recurrence and implementing programs to return people to their original health and function to prevent long-term problems.[14]

Surveillance: The systematic ongoing collection, collation and analysis of nominal data (e.g., data from workers' compensation, occupational screening or occupational health clinics) with timely dissemination of non-nominal information to those who require it in order to take action. The major components of surveillance programs are: periodic identification and collection of health information; evaluation and interpretation of the information; and reporting and intervention for the purpose of prevention.[15]

Tertiary prevention: Reduction of the impact of an ongoing illness or injury that has lasting effects. This is done by helping people manage long-term, often-complex health problems and injuries (e.g., chronic diseases, permanent impairments) in order to improve, as much as possible, their functional ability, their quality of life and their life expectancy.[14]

Visibly soiled hands: Hands on which dirt or body fluids can be seen.

Wet work: Activities where workers have to immerse their hands in liquids for more than two hours per shift or wear waterproof (occlusive) gloves for a corresponding amount of time or wash their hands more than 20 times per shift.[16]

Workplace modifications: Employers accommodate workers in their current job and tasks are modified in order to control or avoid exposures that have caused the irritant or allergic contact dermatitis in those workers. (Also known as workplace adjustments or job modifications.)

Preamble

About This Document

This document provides a series of recommendations for the prevention, early detection and management of occupational contact dermatitis in health care workers (HCWs).

In 2012, researchers from Public Health Ontario (PHO) conducted an environmental scan to identify key issues in Ontario's health care system relevant to occupational health, and infection prevention and control. A detailed survey was sent to members of the Ontario Hospital Association and the Ontario Occupational Health Nurses Association, as well as to contacts in the databases of the former Regional Infection Control Networks (now Regional IPAC Support Team). There were over 1,000 respondents from nursing, occupational health and safety, infection prevention and control, education, clinical management and administration. The respondents represented various health care settings, including hospitals, long-term care homes, emergency medical services, community clinics, home health care, correctional services and social services. A summary of the survey results is available upon request.

Survey respondents identified occupational contact dermatitis as a key area of concern and a serious issue for HCWs. They highlighted the need for education and training on preventive strategies for occupational dermatitis among front-line HCWs and for effective tools to help manage occupational contact dermatitis in those HCWs:

- Approximately two-thirds of respondents (68.7%) felt that they needed education on topics, such as overuse of gloves, use of alcohol-based hand rub (ABHR) after hand washing and alternative glove materials.
- Just over half of respondents (52.9%) identified inconsistent policies, procedures and hand care programs in their workplaces, whereby hand care programs were not consistently present or complied with, and not all workplaces provided emollient hand lotions.
- Over half of respondents (56.4%) felt that more workplace support for HCWs with occupational contact dermatitis was needed and wanted an algorithm to follow in addressing the dermatitis (e.g., when to change glove type, when to refer for medical attention or workplace modifications).

When asked about specific tools that would enhance educational programs related to occupational contact dermatitis, the preferences of the HCWs were consistent across the health care settings surveyed:

- More than three-quarters of respondents (77.5%) felt that a fact sheet or brochure about occupational contact dermatitis would best enhance their knowledge.
- Over half of respondents (59.4%) asked for adaptable teaching materials and 55.2% wanted video clips or a DVD on occupational contact dermatitis.

- Nearly half of respondents (48.9%) asked for narrated presentations or scenarios and 43.6% wanted flowcharts or algorithms to follow.
- Over a third of respondents (38.4%) asked for audit tools and checklists.

The current document was conceptualized, in part, to build a knowledge base around the needs identified in the 2012 survey and to bridge the gaps that exist between knowledge and practice relevant to occupational contact dermatitis in HCWs.

A working group at PHO assembled the occupational dermatitis in health care committee (ODHCC) consisting of members with broad expertise, from a range of stakeholder groups and across multiple disciplines. Members included: physicians; researchers with expertise in occupational contact dermatitis; professionals in infection prevention and control and in occupational health; as well as representatives from the Centre for Research Expertise in Occupational Disease, the Ontario Occupational Health Nurses Association, the Ontario Nurses' Association, the Ontario Ministry of Labour, the Provincial Infectious Diseases Advisory Committee and the Public Services Health & Safety Association. A full list of the committee members is provided in the Acknowledgements.

ODHCC members were instrumental in the development of this document. They were consulted at regular intervals to ensure the document and accompanying resources would adequately address the identified needs of HCWs across all health care settings. Their active participation ensured that the unique interests and perspectives of their respective disciplines were properly represented.

In addition to ODHCC members, the document was circulated to stakeholders identified by the ODHCC for feedback prior to publication. This included experts in dermatology, dentistry, occupational medicine and infection prevention and control; as well as representatives from relevant professional associations (occupational health and safety, occupational medicine, dentistry, occupational health nursing) and two national public health entities. Feedback was incorporated into the document, which included inquiring about tools and receiving suggestions from stakeholders to support implementation of the recommendations.

Scope

This document covers the primary, secondary and tertiary prevention of irritant and allergic contact dermatitis in HCWs in health care settings. The focus is on HCWs with exposures to wet work and allergenic substances in the workplace, with the goal of providing recommendations for the prevention and early diagnosis of contact dermatitis through effective screening, surveillance, education and training, and appropriate clinical assessment and diagnostic testing.

Clinical prognosis and recommendations for workplace interventions, including modified work, as well as the significant impact of disease on personal health and continued employment, are discussed. Health equity is considered. Recommendations are provided on risk assessment, how to apply the occupational hierarchy of controls in the context of prevention of disease, and correct selection and use of gloves and cotton glove liners. Dermatitis as a barrier to hand hygiene best practices is reviewed, together with

recommendations for the regular use of emollient hand creams or lotions (that are free of allergens) to maintain skin integrity. Risk for colonization and transmission of microbial organisms when skin is not intact is also covered. Recommendations for tertiary clinical management are considered out of scope.

How and When to Use This Document

The recommendations put forward in this document are intended for front-line HCWs; those who provide advice to HCWs on hand care (e.g., employers, supervisors, managers); those involved in the diagnosis and basic clinical management of contact dermatitis (e.g., occupational health, infection prevention and control, and primary care professionals); joint health and safety committee members, and health and safety representatives; procurement professionals; and others. The impact of the recommendations and how they are used will depend on the individual's role in the health care setting (Table 1).

Recommendations from this document can be used to complete an organizational risk assessment to eliminate, substitute or engineer changes in the workplace that reduce exposures to irritant or allergenic substances. Effective education and training programs, policies and procedures, together with ready access to appropriate hand-care products and gloves, will support the HCW, their supervisor(s), educators and management in preventing or mitigating occupational contact dermatitis in the workplace.

Table 1. Impact of Recommendations Based on Role within Health Care Settings

Role	Impact of Recommendations
Front-line health care workers (HCWs)	Direct beneficiaries of recommendations for improved prevention, detection and management of occupational contact dermatitis. Note: Resources specific to the educational needs of each sector of this heterogeneous population (e.g., nurses, environmental service workers, home-care workers, dental assistants) need to be developed.
Occupational Health, Infection Prevention and Control, primary care professionals, educators	Provides an evidence-based approach to the early detection of disease, advice regarding screening, hand hygiene, emollients, use of gloves and cotton glove liners, as well as recommendations for modified work.
Employers, supervisors, managers	Promotes provision and support of resources for effective education and training of HCWs, as well as ready access to hand-care products (emollients) and gloves.

Role	Impact of Recommendations
Joint health and safety committee; health and safety representatives	Provides evidence-based information to educate health and safety committees and representatives.
Procurement	Ensures appropriate selection of hand care products (emollients), gloves and glove liners within health care settings.

Document Limitations

The recommendations outlined in this document reflect the best evidence and expert opinion available at the time of publication.

This document will be reviewed and updated as new evidence becomes available, where subject matter experts evaluate this new evidence as having significant impact on the recommendations.

Applicable Legislation

Employers in Ontario are required to comply with all applicable health and safety legislation.

The *Occupational Health and Safety Act*, RSO 1990, c O.1 (OHSA) and its regulations set out the legislated rights, duties and obligations of employers, supervisors and workers to keep Ontario's workplaces safe.[17] The internal responsibility system is the underlying philosophy for this legislation, whereby all workplace parties have a role to play to ensure that health and safety requirements are met in the workplace.[18,19]

The OHSA clearly states that employers have the greatest responsibilities with respect to health and safety. Clause 25(2)(h) of the OHSA requires employers to take every precaution reasonable in the circumstances for the protection of a worker. In addition, subsection 52(2) of the OHSA requires employers to report occupational illnesses to the Ministry of Labour, the joint health and safety committee or health and safety representative, and the trade union, if any. Section 28 of the OHSA states that workers are required to work in compliance with the OHSA and its regulations, and use or wear any equipment, protective devices or clothing required by the employer.

Under the OHSA, specific requirements for certain health care and residential facilities may be found in *Health Care and Residential Facilities*, O Reg 67/93.[20] Under that regulation, there are a number of requirements in sections 8, 9 and 10:

a) An employer shall establish written measures and procedures for the health and safety of workers, in consultation with the joint health and safety committee or health and safety representative, if any. Such measures and procedures may include, but are not limited to:

- safe work practices
- safe working conditions
- proper hygiene practices and use of hygiene facilities
- control of infections
- immunization and inoculation against infectious diseases
- use of appropriate antiseptics, disinfectants and decontaminants
- protection from hazards of biological, chemical and physical agents
- use, wearing and care of personal protective equipment and its limitations

b) At least once a year, the measures and procedures for the health and safety of workers shall be reviewed and revised in the light of current knowledge and practice.

c) The employer, in consultation with the joint health and safety committee or health and safety representative, if any, shall develop, establish and provide training and educational programs in health and safety measures and procedures for workers that are relevant to the workers' work.

d) A worker who is required by his or her employer, or by *Health Care and Residential Facilities*, O Reg 67/93, to wear or use any protective clothing, equipment or device shall be instructed and trained in its care, use and limitations, before wearing or using it for the first time and at regular intervals thereafter, and the worker shall participate in such instruction and training.

e) Personal protective equipment that is to be provided, worn or used shall,

- be properly used and maintained
- be a proper fit
- be inspected for damage or deterioration
- be stored in a convenient, clean and sanitary location when not in use

The employer is reminded of the need to be able to demonstrate training and is therefore encouraged to document the workers trained, the dates training was conducted and the information and materials covered during training.

Other applicable occupational health and safety legislation may include the *Workplace Safety and Insurance Act, 1997*, SO 1997, c 16, Sched. A, the *Workplace Hazardous Materials Information System* (WHMIS), RRO 1990, Reg 860 and the *Globally Harmonized System of Classification and Labelling of Chemicals*.[21,22] In federal jurisdictions, the *Canada Labour Code*, RSC 1985, c L-2 and the *Canada Occupational Health and Safety Regulations*, SOR/86-304 may be applicable.[23,24]

Health Equity Considerations

As a scientific and technical agency, PHO strives to enable informed decisions and actions that protect and promote health and contribute to reducing health inequities. The principles of health equity and social justice are inherently rooted in all public health work and articulated in the legislated purpose of *Ontario Agency for Health Protection and Promotion Act, 2007*, SO 2007, c 10, Sched. K.[25] PHO has adopted the World Health Organization's definition of health inequity.[26]

Health inequities result from the inequitable distribution of power, money and resources, and inequitable access to the resources necessary for health.[27] PHO is committed to addressing health equity considerations in its key areas of expertise and activity, including operational planning and policy development.[25]

In this document, several core determinants of health are considered when addressing the prevention, diagnosis and management of occupational contact dermatitis in health care settings.

Income and social status. There is strong evidence that social status and higher incomes are associated with better health outcomes, including positive effects on physical, mental and social health. In addition to income, paid work offers a sense of identity and purpose, as well as social contacts (e.g., support from co-workers and supervisors/managers) and personal growth opportunities.[28]

HCWs who develop chronic, severe contact dermatitis may eventually be unable to continue work and could suffer considerable loss of income and social status. A focus on prevention and early detection of skin disease, along with appropriate work modification, could result in reduced severity of disease and continued employment.

Education and literacy. Education and literacy vary widely across the continuum of HCWs. Tools and resources should be developed to meet the unique needs of different populations of workers and those responsible for their education and training. Tools with graphic elements and simple language could help address the needs of front-line HCWs with limited language literacy.

Employment and working conditions. HCWs have varied physical, chemical and biological exposures in the work environment, which can increase their risk of developing or exacerbating occupational contact dermatitis. These include exposure to wet work (e.g., gloving, frequent hand hygiene) and chemicals (e.g., methacrylates in dental and operating room settings, cleaning agents, rubber accelerators in gloves) and microbial exposures (e.g., methicillin-resistant *Staphylococcus aureus*) to nonintact skin. These exposure risks, and how to manage them, are specifically addressed in the document.

HCWs should be informed (e.g., through orientation) of all benefits and entitlements available to them through their employer; and through relevant legislation, such as the *Occupational Health & Safety Act*, RSO 1990, c O.1, the *Workplace Safety and Insurance Act, 1997*, SO 1997, c 16, Sched. A and the *Ontario Human Rights Code*, RSO 1990, c H.19.[29] These benefits and entitlements may be relevant in the following situations:

- Where work may be precarious, casual or contracted, HCWs with few scheduled work hours could be concerned about losing paid work opportunities through absence due to occupational dermatitis. This may lead them to under-report their condition.
- Full-time employment may offer insurance benefits, such as coverage for prescription medications and topical treatments, that may be unavailable to part-time or casual workers.
- Some small business employers may be unable to provide redeployment. When a person loses employment or their employment status changes, there can be significant negative implications for the health of both the individual and his or her family.[28]

Physical environments. Working in a climate that can be cold and dry for several months of the year also contributes to increased prevalence of dermatitis.

Biology and genetic endowment. HCWs with a genetic predisposition to eczema or other skin disorders (e.g., psoriasis) are more likely to develop or exacerbate occupational contact dermatitis. There is difficulty in early recognition of dermatitis on pigmented skin because erythema is more difficult to observe. Awareness of host genetic factors, combined with a targeted education program, may reduce the burden of disease.

Health services. Access to clinical assessment, diagnosis and treatment of dermatitis varies across health care settings and geography. Larger hospitals have on-site occupational health services, where assessment and work accommodation can be completed or facilitated through the family physician or community specialist. In long-term, pre-hospital and home-care settings, there may not be access to these on-site services, thus creating barriers to accessing timely clinical assessment, diagnosis and treatment. There are often waiting periods to see a family physician and even longer waits to see a specialist. Health care settings in small rural or remote communities have access to even fewer resources. The development of simple self-assessment tools and resources for the front line may assist with early recognition of disease and management. Additional work needs to be done to facilitate access to appropriate care.

Gender. HCWs remain predominantly female, and thus account for the greatest burden of occupational contact dermatitis. Women with young children at home have an even higher incidence of contact dermatitis. Knowledge translation activities should consider female gender in devising a communication strategy and suitable resources for the home environment.

Methodology Overview

The PHO working group performed an extensive literature search to identify high-quality, comprehensive guidelines that would inform the selection of research questions for the current document. The AGREE-II tool was applied to the guidelines that were identified to ensure that they were of high quality. Three comprehensive guideline documents with high AGREE II scores, particularly in the rigour of development domain, were selected:

- National Health Services Scotland (NHS) Plus, Royal College of Physicians and Faculty of Occupational Medicine joint national guidelines on occupational aspects of management of dermatitis, 2009 (Referred to as RCP Guidelines in this document)
- British Occupational Health Research Foundation (BOHRF) guidelines on occupational contact dermatitis and urticaria, 2010 (Referred to as BOHRF Guidelines in this document)
- Health Protection Scotland (HPS) Literature Review on standard infection control precautions (SICP) related to hand hygiene and skin care, 2016 (Referred to as HPS SICP Literature Review in this document)

Using these published guidelines and their associated systematic reviews as a foundation, and in consultation with a broad range of key stakeholders, an initial list of research questions was reviewed by the occupational dermatitis in health care committee (ODHCC). Questions were added or modified based on the specific needs and regional context of health care settings in Ontario, Canada. Broadly, questions covered aspects of primary, secondary and tertiary prevention and diagnosis; management of occupational contact dermatitis; impact on workers, and infection prevention and control. Consensus was reached on 29 research questions for inclusion. (See Summary of Research Questions.)

Systematic Literature Search

Literature searches were developed by library information specialists in conjunction with the working group. MEDLINE, Embase, and CINAHL databases were searched for articles from January 1980 to January 2017. Grey literature searches of guidelines were completed, together with a brief scan of conference abstracts. Experts from the ODHCC were asked to identify any articles that may not have been captured in the literature search. A few additional articles were provided.

Review of Abstracts

The search yielded a total of 11,970 results. Experimental and observational studies were included. Generally, qualitative studies were excluded except for outcomes related to preferences, values and impact on workers. Case series, case reports, opinions, editorials, commentaries and reviews were excluded. Populations included were those occupations with high risk of occupational contact dermatitis, particularly as a result of wet work. Two independent reviewers screened the search results

for full text review. Two independent reviewers determined whether articles marked for full text review would be included. Reference lists were scanned to identify additional articles. Consensus was used in cases of disagreement, or a third reviewer acting as an arbitrator made a final decision. In total, 52 peer-reviewed publications were selected to inform the recommendations presented in the document.

Critical Appraisal of Papers

During the data abstraction step, limitations related to the study design and results were included based on authors' stated limitations and abstractors' informal critical appraisal. Single reviewer abstraction with validation by another reviewer was conducted. Studies were excluded if significant issues with the applicability of the data were identified from the critical appraisal (e.g., use of hand hygiene products no longer used in health care settings or employing strategies contrary to infection control protocols, such as reducing hand hygiene frequency).

Evidence Tables

Evidence tables were developed in advance and populated by a single reviewer, then validated by a second reviewer. The tables included study information (e.g., sample size, study design, timeframe, interventions and comparisons); study participants (e.g., occupation, job sector, demography); outcomes measured; effects reported; and main conclusions. Information on study quality, including considerations of relevance, reliability, validity and applicability, was also included in a limitations column.

Evidence Statements and Recommendations

Evidence statements, written based on the evidence tables, were reviewed by the ODHCC and used to inform the development of recommendations. The body of evidence was not formally graded but limitations of individual studies were considered when forming recommendations. (See Summary of Recommendations.)

Summary of Research Questions

The full list of research questions is presented in Table 2, along with the relevant discussion section in the document for each question and, where sufficient evidence existed, the recommendation put forward by the occupational dermatitis in health care committee (ODHCC). (See Summary of Recommendations.)

Table 2. Research Questions, Relevant Document Sections and Recommendations

#	Research Question	Document Section	Recommendation Number(s)
1	What personal factors could be measured at preplacement to better inform the management of risk for occupational dermatitis?	2.1	Insufficient evidence; no recommendations
2	Is the incidence of occupational contact dermatitis reduced by controlling exposure through elimination or substitution?	2.2	8
3	Does avoidance or control of exposure lead to improvement or recovery?	2.2	2
4	Do education and training programs help prevent the development of occupational contact dermatitis?	2.3.1	12
5	Do education and training programs increase the likelihood of secondary prevention of occupational contact dermatitis?	2.3.1	12
6	Do education and training programs for management of occupational contact dermatitis enable affected workers to avoid occupation change, job loss or retirement?	2.3.1	12
7	Does skin screening prevent occupational contact dermatitis?	2.3.2	Insufficient evidence; no recommendations
8	Does skin health surveillance prevent occupational contact dermatitis?	2.3.2	Insufficient evidence; no recommendations

#	Research Question	Document Section	Recommendation Number(s)
9	Does skin screening result in earlier diagnosis of occupational contact dermatitis?	2.3.2	7
10	Is skin screening to identify workers with suspected occupational contact dermatitis for further evaluation by a dermatologist using a self-administered questionnaire (symptoms- and/or picture-based) effective to replace screening by skin inspection by a trained occupational health expert?	2.3.2	7
11	Does the application of emollients help prevent the development of occupational contact dermatitis?	2.3.3	13
12	Do prework (barrier) creams help prevent the development of occupational contact dermatitis?	2.3.3	16
13	How can skin integrity be maintained when performing hand hygiene in order to minimize the development of occupational contact dermatitis?	2.3.3	14, 15, 17, 18, 20, 21
14	Does adhering to hand hygiene best practices, including a hand care program and appropriate selection and use of gloves, improve primary prevention of dermatitis in the workplace?	2.3.3	12
15	What is the comparative effectiveness of different hand hygiene best practices, including a hand care program and appropriate selection and use of gloves, on the primary prevention of occupational contact dermatitis?	2.3.3	Insufficient evidence; no recommendations
16	Does adhering to hand hygiene best practices, including a hand care program and appropriate selection and use of gloves, improve secondary prevention of dermatitis in the workplace?	2.3.3	12, 16, 19, 22
17	What is the comparative effectiveness of different hand hygiene best practices, including a hand care program and appropriate selection and use of gloves, on the secondary prevention of occupational contact dermatitis?	2.3.3	Insufficient evidence; no recommendations
18	Does adhering to hand hygiene best practices, including a hand care program and appropriate selection and use of gloves, improve tertiary prevention of dermatitis in the workplace?	2.3.3	6, 12, 16, 19, 22

#	Research Question	Document Section	Recommendation Number(s)
19	What is the comparative effectiveness of different hand hygiene best practices, including a hand care program and appropriate selection and use of gloves, on the tertiary prevention of occupational contact dermatitis?	2.3.3	Insufficient evidence; no recommendations
20	What evidence is there for benefit of workplace modification for tertiary prevention of occupational contact dermatitis?	2.3.4	2, 6
21	What evidence is there for benefit of redeployment for tertiary prevention of occupational contact dermatitis?	2.3.4	5
22	Is the incidence of occupational contact dermatitis reduced by personal protective equipment (i.e., gloves [including cotton glove liners])?	2.4	9, 10
23	What evidence is there for benefit of use of personal protective equipment (i.e., gloves [including cotton glove liners]) for tertiary prevention of occupational contact dermatitis?	2.4	11
24	How effective are the criteria for the diagnosis of occupational contact dermatitis to differentiate from nonoccupational contact dermatitis or other skin diseases?	2.5	1, 3, 4, 7
25	Does earlier diagnosis of occupational contact dermatitis make a difference in outcomes?	2.5	7
26	What is the clinical prognosis for workers with occupational contact dermatitis?	2.6	1, 2
27	What is the impact of occupational contact dermatitis on the worker, including e.g., work life, personal life and employment?	2.7	6
28	Are health care workers with dermatitis at higher risk for skin colonization or skin infection than health care workers without dermatitis?	2.8	23
29	Are health care workers with dermatitis more likely to transmit infections to patients than health care workers without dermatitis?	2.8	24, 25

Summary of Recommendations

The literature search strategy and review process yielded a total of 52 peer-reviewed publications to inform the recommendations put forward in this document. The PHO working group developed and applied a data extraction template to these publications. A table of evidence for each research question was produced by extracting data from the relevant articles. Evidence statements and resulting recommendations were reviewed, revised, and ultimately agreed upon by the occupational dermatitis in health care committee (ODHCC).

Grading of Recommendations

The ODHCC adapted the grading scheme of the Provincial Infectious Diseases Advisory Committee.[30] The quality of the evidence (see Table 3) was based primarily on the study designs of the evidence evaluating the efficacy of an intervention. The strength of the recommendation (see Table 4) took into account the ODHCC's assessment of the quality of the evidence and the potential risks associated with the intervention, as follows:

- Category A recommendations for an intervention are those where the ODHCC determined that the benefit of the intervention clearly outweighs the risks. ***The ODHCC intends that category A recommendations must be followed in all applicable health care settings***.

  Note: For interventions with no or trivial associated risks (e.g., Recommendation 1), weak supportive evidence can result in a category A recommendation, as benefits will clearly outweigh risks.

- Category B recommendations for an intervention are those where benefits most likely outweigh the risk in most settings. ***The ODHCC intends that category B recommendations should be followed in most applicable health care settings***.

Categories A and B recommendations may also be made against an intervention if the risks of the intervention clearly or most likely outweigh the benefits.

Table 3. Assessment of the Quality of Evidence Supporting a Recommendation

Grade	Definition
I	Evidence from at least one properly randomized, controlled trial.
II	Evidence from at least one well-designed clinical trial without randomization, from cohort or case-control analytic studies, preferably from more than one centre, from multiple time series or from dramatic results in uncontrolled experiments.
III	Evidence from opinions of respected authorities on the basis of clinical experience, descriptive studies or reports of expert committees.

Table 4. Determination of the Strength of a Recommendation

Category	Definition
A	Recommendations that must be followed in all health care settings. The benefits of these practices outweigh the risks.
B	Recommendations that should be followed in most health care settings. The benefits of these practices likely outweigh the risks in most, but not all, settings and situations.

NOTE: When a recommendation is based on a regulation, no grading will apply.

Final Recommendations

The recommendations for occupational contact dermatitis put forward by the ODHCC are summarized in Tables 5 through 12. There is a total of 25 recommendations numbered sequentially across eight categories, as follows:

- Assessment and diagnosis (Table 5)
- Workplace management (Table 6)
- Screening and surveillance (Table 7)
- Gloves (personal protective equipment) and exposure control (Table 8)
- Skin care programs (including education) (Table 9)
- Emollient hand creams and lotions (Table 10)
- Hand hygiene (Table 11)
- Infection prevention and control (Table 12)

For each recommendation, the rating (strength of the recommendation), section(s) in the document where relevant discussions can be found and associated research question(s) are provided.

Table 5. Recommendations for the Assessment and Diagnosis of Occupational Contact Dermatitis—Ratings, Relevant Document Sections and Research Questions

#	Recommendation	Rating	Document Section(s)	Research Question(s)
1	Health care practitioners should take a full occupational history and relevant nonoccupational history when a health care worker presents with a skin rash, asking the health care worker about their job, the materials with which they work, the location of the rash and any temporal relationship with work. A clinical assessment should be made by the health care practitioner to inform medical treatment and workplace modifications.	IIA	2.5; 2.6	24; 26
2	If the diagnosis is uncertain or the dermatitis is persistent despite clinical assessment and treatment by the health care practitioner, then the health care worker should be assessed by a physician with expertise in occupational contact dermatitis for recommendations regarding appropriate medical treatment and workplace modifications.	IIIB	2.2; 2.3.4; 2.6	3; 20; 26
3	A diagnosis of occupational contact dermatitis should be confirmed by a physician (e.g., dermatologist) with the knowledge, skills and training to diagnose this condition with reasonable accuracy (including objective testing where indicated), and not be made solely on the basis of a compatible history.	IIA	2.5	24
4	In order to provide additional diagnostic information, a physician with expertise in occupational contact dermatitis may conduct custom patch testing using haptens that are not commercially available in a standard tray.	IIIB	2.5	24

Table 6. Recommendations for Workplace Management of Occupational Contact Dermatitis—Ratings, Relevant Document Sections and Research Questions

#	Recommendation	Rating	Document Section(s)	Research Question(s)
5	If workplace modifications are unsuccessful, redeployment should be considered as the next step before occupation change, job loss or retirement.	IIIB	2.3.4	21
6	Specialized, intensive individual prevention programs, including workplace modification, should be developed for health care workers with moderate to severe occupational contact dermatitis. These programs should use approaches that target improvements in both physical and mental health.	IIIB	2.3.3; 2.3.4; 2.7	18; 20; 27

Table 7. Recommendations for Screening and Surveillance of Occupational Contact Dermatitis—Ratings, Relevant Document Sections and Research Questions

#	Recommendation	Rating	Document Section(s)	Research Question(s)
7	As timely diagnosis of contact dermatitis within one year of onset of symptoms can improve outcomes, routine screening (preplacement and periodic) using a validated and feasible tool can be used to identify individuals who may benefit from further expert evaluation and diagnosis.	IIIB	2.3.2; 2.5	9; 10; 24; 25

Table 8. Recommendations for Gloves (Personal Protective Equipment) and Exposure Control in Occupational Contact Dermatitis—Ratings, Relevant Document Sections and Research Questions

#	Recommendation	Rating	Document Section(s)	Research Question(s)
8	Employers should implement strategies to eliminate or reduce exposure to agents that cause occupational contact dermatitis.	IIA	2.2	2
9	Employers should provide appropriate gloves where the risk of developing occupational contact dermatitis cannot be eliminated by removing exposure.	IIA	2.4	22
10	When occlusive glove use cannot be reduced or eliminated, using cotton glove liners may decrease the incidence of occupational contact dermatitis.	IIIB	2.4	22
11	When glove use is indicated, health care workers with hand dermatitis should be provided with cotton glove liners and instructed on their use.	IIIB	2.4	23

Table 9. Recommendation for Skin Care Programs (Including Education) in Occupational Contact Dermatitis—Ratings, Relevant Document Sections and Research Questions

#	Recommendation	Rating	Document Section(s)	Research Question(s)
12	Employers should provide ongoing education, training, information, resources and products that will reduce the incidence and prevalence of occupational contact dermatitis in health care workers. A multifaceted hand hygiene program is recommended to effect behaviour change. The program should include: targeted and sustained education and training on hand hygiene best practices; a hand care program with education on skin self-screening and reporting; direction for appropriate selection and use of gloves, emollient hand creams and lotions; and provision of ready access to emollient hand creams and lotions, hand hygiene products and appropriate gloves.	IIA	2.3.1 ; 2.3.3	4; 5; 6; 14; 16; 18

Table 10. Recommendations for the Use of Emollient Hand Creams and Lotions in Occupational Contact Dermatitis—Ratings, Relevant Document Sections and Research Questions

#	Recommendation	Rating	Document Section(s)	Research Question(s)
13	Employers should provide emollient hand lotions in the workplace and educate health care workers to use them regularly.	IA	2.3.3	11
14	To prevent contamination, emollient hand lotions should be provided by the facility in dispensers or pumps that are not topped up or refilled.	IIA	2.3.3	13
15	Communal tubs and tubes of hand cream or lotion should not be used.	IIA	2.3.3	13
16	Employers should not promote the use of prework (barrier) creams by health care workers in health care settings.	IIB	2.3.3	12; 16; 18
17	Emollient hand creams or lotions, that are free of allergens, should be used regularly. Hand creams or lotions should be applied all over the hands, including between the fingers and the back of the hand.	IIA	2.3.3	13
18	Emollient hand creams and lotions used in the health care setting must not compromise the efficacy of the hand hygiene products or gloves used.	IIIA	2.3.3	13
19	Workers with existing dermatitis should be advised to use emollient hand creams or lotions, that are free of allergens, at work.	IIIA	2.3.3	16; 18

Table 11. Recommendations for Hand Hygiene in Occupational Contact Dermatitis—Ratings, Relevant Document Sections and Research Questions

#	Recommendation	Rating	Document Section(s)	Research Question(s)
20	Workers should use alcohol-based hand rub containing emollients as the preferred method of hand hygiene when hands are not visibly soiled.	IIB	2.3.3	13
21	Hands should not be washed immediately after using alcohol-based hand rub.	IIIA	2.3.3	13
22	Health care workers with dermatitis should use alcohol-based hand rub containing emollients, if tolerated, when hands are not visibly soiled. Those who experience discomfort from hand hygiene should be individually assessed, preferably by an occupational health professional.	IIB	2.3.3	16; 18

Table 12. Recommendations for Infection Prevention and Control in Occupational Contact Dermatitis—Ratings, Relevant Document Sections and Research Questions

#	Recommendation	Rating	Document Section(s)	Research Question(s)
23	Health care practitioners should advise health care workers with dermatitis that areas of skin affected by dermatitis are more likely than normal skin to be colonized with microorganisms and that this risk is higher with more acute and more severe lesions.	IIA	2.8	28
24	Health care practitioners should advise health care workers with dermatitis, who may be at increased risk for colonization, that there is a potential risk they are more likely than health care workers who do not have dermatitis to transmit microorganisms that could colonize or cause infection (e.g., methicillin-resistant *Staphylococcus aureus*) to patients.	IIIA	2.8	29
25	For health care workers who have hand dermatitis, health care practitioners may recommend, during disease outbreaks, temporary redeployment to jobs that do not involve direct patient care. For health care workers who have moderate to severe dermatitis and provide direct care to patients who are at increased risk for infection (e.g., neonates, severely immunocompromised patients, patients in intensive care or post-operative units), temporary redeployment may be recommended until symptoms resolve or are reclassified as mild.	IIIB	2.8	29

1. Background

1.1 Structure and Function of the Skin

The skin is the largest and heaviest organ in the body (see Figure 1), accounting for 15% of body mass and covering up to two square metres in surface area. Composed of approximately 75% water, 20% protein and 5% fat, it is our body's primary interface with the external environment.[31,32] The skin is responsible for many functions, including protection from injury, water preservation, temperature control, lubrication, tactile sensation and vitamin D synthesis.[33] The skin is also remarkably resilient to chemical exposure, extreme temperatures, infectious agents, abrasions and trauma, and it has a tremendous capacity to repair itself.

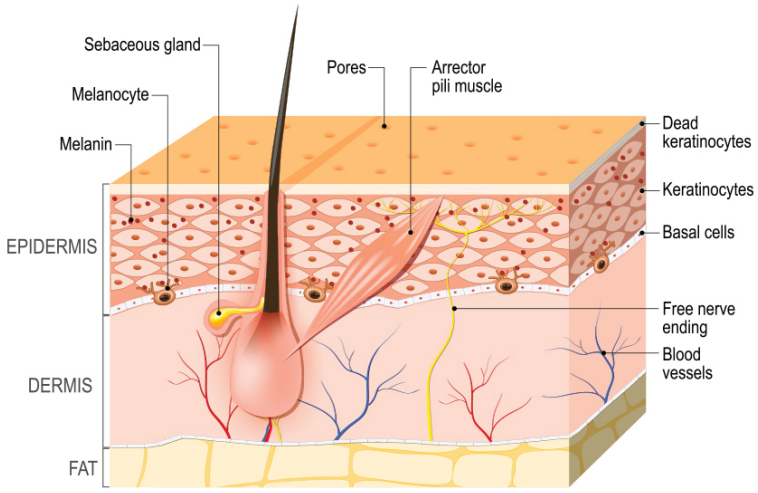
Human skin consists of a cellular epidermis that is stratified (layered) and overlies a dermis of connective tissue, separated by a dermal-epidermal basement membrane. The epidermis is only 50 to 100 microns thick and is made up mostly of brick-shaped cells called keratinocytes, composed of keratin and filaggrin and make up 80% to 90% of the mass of the epidermis. Cell divisions begin in the basal layer and it takes about 30 days for new cells to reach the skin surface. By the time they do, the keratinocytes have flattened and lost their nuclei and become known as corneocytes or skin squames.[31,33]

The stratum corneum is the outermost layer of the epidermis and functions as gatekeeper and principal barrier against the penetration of chemicals and microbes. It is capable of withstanding mechanical forces and regulates water release into the atmosphere, known as transepidermal water loss.[34]

The structure of the stratum corneum is often described as a brick wall, where the bricks are the corneocytes and the space between the cells is the mortar holding the bricks together). Corneodesmosomes are protein structures that act like rivets to hold the corneocytes together. Intercellular lipids (ceramides, cholesterol and free fatty acids) bind the corneocytes together, stopping them from desiccating (drying out).[35] It is this unique structure that creates the highly impermeable lipid barrier that keeps the skin hydrated (by preventing trans-epidermal water loss); keeps the skin smooth (by preventing loss of natural moisturizing factor); protects against abrasive action; and prevents harmful microorganisms or irritants from entering the skin.[36-39]

The dermis beneath the epidermis is about one to two millimetres thick and contains connective tissue, hair follicles and sweat glands. Below the dermis lies the hypodermis, which is also about two millimetres thick and is made up of connective and fatty tissue.

Figure 1. Anatomy of the Skin



1.2 Occupational Contact Dermatitis

The epidermis is constantly being regenerated, as skin squames are routinely shed. Inflammation of the skin can result when the rate of damage or wear to the epidermal layer exceeds the rate of repair. The term dermatitis is used to describe a group of diseases or conditions characterized by inflammation of the skin.

Contact dermatitis is an inflammation of the skin that results from direct contact of a substance with the surface of the skin.[1] The term occupational contact dermatitis is used when the contact or exposure occurs in the workplace. Common causes of contact dermatitis include chemicals that dry or irritate the skin, such as strong soaps or cleaning agents; or substances that cause an allergic reaction, such as nickel or poison ivy.[3]

There are two main types of contact dermatitis.

1.2.1 Irritant Contact Dermatitis

Irritant contact dermatitis (see Figure 2) occurs when the skin is directly exposed to substances that irritate the skin. The result is an inflammatory, nonimmunological reaction that is usually localized to the site of contact. Irritants include soaps, detergents, solvents like alcohols and water and other chemicals.[40] Symptoms include itchy, painful or burning skin that can appear as a red rash, bumps, blisters and/or draining fluid. Factors that impact the extent of the skin response include the type, amount and concentration of the irritant, as well as the duration and frequency of the exposure.[1]

Available data indicate that irritant contact dermatitis represents approximately 80% of all cases of occupational contact dermatitis. Irritant contact dermatitis may manifest as acute exposures to highly irritating substances (e.g., acids, bases, oxidizing/reducing agents) or chronic cumulative exposures to mild irritants (e.g., water, detergents, weak cleaning agents).[34]

Once irritant contact dermatitis has developed, the damaged skin becomes more susceptible to irritation from even small amounts of a substance. This cycle may result in further inflammation and damage and can take many months to heal.

Figure 2. Irritant Contact Dermatitis

(Image source: Heilman J. Human hand with dermatitis. Available from: https://upload.wikimedia.org/wikipedia/commons/8/86/Human_hand_with_dermatitis.jpg. Used with permission available from: https://commons.wikimedia.org/wiki/File:Human_hand_with_dermatitis.jpg)

1.2.2 Allergic Contact Dermatitis

Allergic contact dermatitis (see Figure 3) occurs when a substance triggers an allergic skin response. It is caused by a wide range of chemicals, such as nickel, fragrances, dyes, rubber products, rubber accelerators used in glove manufacturing, topical medications and cosmetics.[1,3] The skin reaction can spread beyond the area of skin contact. Substances that cause allergic reactions are called allergens.

Allergies are hypersensitivity reactions in which the immune system, which normally serves a protective role, has a harmful effect.[41] While there are four classifications of hypersensitivity reactions, types I through IV, only type IV is relevant to allergic contact dermatitis. One notable example relevant in health care settings is the use of latex gloves with rubber accelerators, which can cause a type IV reaction (allergic contact dermatitis) to rubber accelerators. This example is often highlighted, as it is also possible for a type I reaction to latex (see occupational contact urticaria) to occur at the same time as the type IV reaction.

Type IV allergies are delayed, cell-mediated immunological reactions that occur in two distinct phases—sensitization on initial exposure, followed by elicitation on re-exposure. In the elicitation phase, onset of skin eruption is typically delayed from 4 to 24 hours following re-exposure. The interval of time for sensitization to a substance can vary from days or weeks, to up to months or years and can occur after a single exposure or multiple re-exposures. Once a person is sensitized, the allergy is likely to be lifelong.

Factors such as temperature, humidity, genetic predisposition and previous or concurrent skin irritation can contribute to allergic sensitization.[42]

Figure 3. Allergic Contact Dermatitis

(Image source: Iliades C. What's causing your skin rash? Everyday Health. Ziff Davis, LLC. 2017 [cited 2018 Dec 3]. Image 11/12: Contact dermatitis: a skin rash caused by irritation or allergy. Available from: https://www.everydayhealth.com/skin-and-beauty-photos/common-skin-rashes.aspx)

Terminology relevant to contact dermatitis can be confusing.[43,44] For example, there is no universal agreement on the definitions of eczema and dermatitis, which are often used interchangeably. Both terms are used throughout the document. Although eczema can occur elsewhere on the body, the focus of this document is on hand dermatitis, also referred to as hand eczema.

Occupational contact dermatitis can be acute (lasting for less than three months and/or occurring only once in a calendar year) or chronic (lasting for at least three months, with at least two relapses in a calendar year).[45] Chronic eczema, which ranges in severity from mild to severe, can be quite disabling for workers, impacting their quality of life and ability to work.[46,47]

The signs of dermatitis vary based on severity of the disease (see Table 13). Dermatitis often begins with dryness and mild erythema (redness) that can progress to cracking, fissures and weeping vesicles (blisters) in severe dermatitis. Those with chronic dermatitis, particularly atopic dermatitis, may develop lichenification (thickening of the epidermis and accentuation of skin lines) as a result of chronic rubbing or scratching.[48] See Appendix A for additional considerations for infection prevention and control relevant to disease severity.

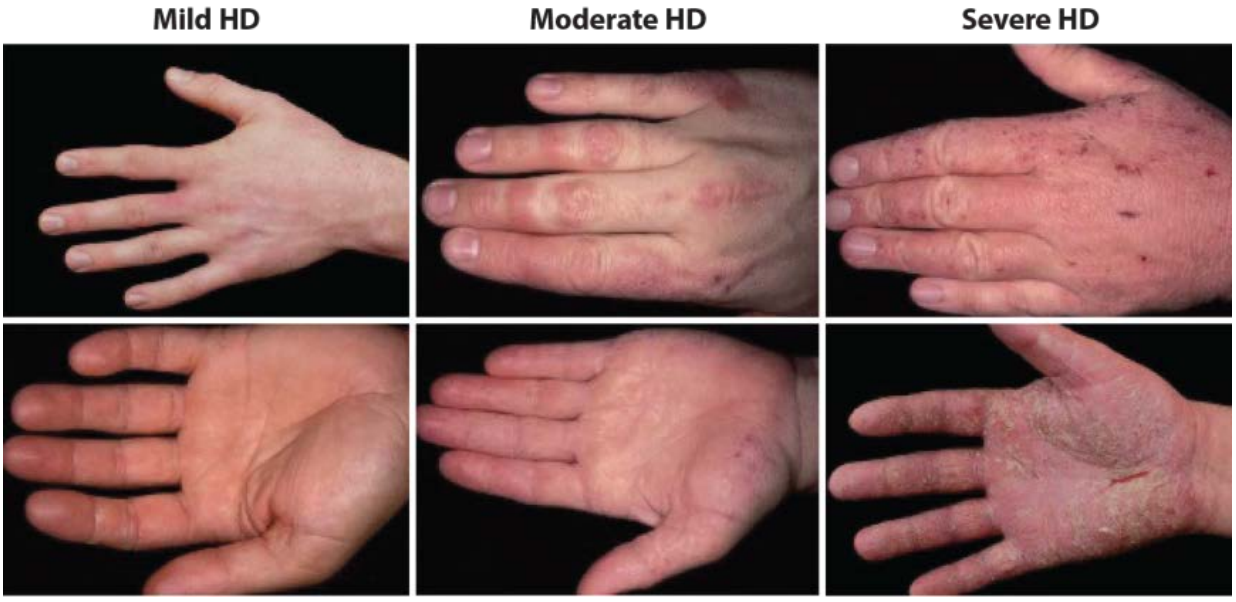
Table 13. Signs of Dermatitis Based on Severity of Disease*

Normal Skin	Mild Dermatitis	Mild to Moderate Dermatitis	Moderate Dermatitis	Moderate to Severe Dermatitis	Severe Dermatitis
No abnormalities	Dryness, mild erythema	Dryness, erythema and cracking	Dryness, moderate erythema, cracking and scaling, with or without some minor vesicles	Moderate dryness and erythema, cracking, scaling and weeping vesicles	Severe dryness and erythema, cracking, fissures and weeping vesicles

* See Appendix A for more information on infection prevention and control practices (hand hygiene, glove use and patient care) based on disease severity.

The hands are the most common body area affected by occupational contact dermatitis. A 2016 study of health care workers (HCWs) in Australia reported that nearly 90% of occupational contact dermatitis cases were related to hand eczema.[46] The wrists, forearm and face are also commonly affected.[46,49-51] Figure 4 illustrates the appearance of the hands with dermatitis of varying severity.

Figure 4. Appearance of Mild, Moderate and Severe Hand Dermatitis (HD)



(Image source: Gooderham M, Bourcier M, de Gannes G, Dhadwal G, Fahim S, Gulliver W, et al. Management of chronic hand dermatitis: a practical guideline for the general practitioner. *Skin Ther Lett, Fam Pract*. 2016;11(1):3139. Available from: http://www.skintherapyletter.com/eczema/chronic-hand-dermatitis/. Used with permission.)

There is a significant economic burden associated with occupational contact dermatitis arising from medical care costs, loss of productivity and time off work.[46] There are also health and safety concerns associated with occupational contact dermatitis, as HCWs with occupational contact dermatitis may be at higher risk of colonization or infection of their damaged skin and may be more likely to transmit microorganisms to their patients. (See 1.21 Infection Prevention and Control for more information on infection prevention and control in HCWs.)

1.2.3 Occupational Contact Urticaria

Occupational contact urticaria is defined as the immediate development of a wheal-and-flare reaction at a site where an external agent contacts the skin, in the context of a work setting. Contact urticaria can occur as a nonimmunological or immunological reaction. Nonimmunological occupational contact urticaria does not require prior allergen exposure, while immunological occupational contact urticaria is a type I, immunoglobulin E–mediated hypersensitivity reaction in which the patient's immune system has been previously sensitized to the eliciting allergen (e.g., latex).[12] Occupational contact urticaria appears on the skin as red, itchy, swollen wheals or hives that range in size and can appear anywhere on the body.[13] Symptoms can begin within minutes of exposure. In health care settings, exposure to powdered latex gloves has been the most common cause of occupational contact urticaria. In addition to skin symptoms, respiratory symptoms ranging from nasal stuffiness and runny nose, up to severe asthmatic reactions and anaphylaxis, have been reported due to exposure to latex proteins in glove powder. Recommendations related to occupational contact urticaria were generally out of scope for this report.

1.3 Prevalence and Incidence

It is estimated that occupational contact dermatitis accounts for 70% to 90% of reported occupational skin diseases in developed countries.[49,50]

Rates for incidence, prevalence and reoccurrence of occupational contact dermatitis are difficult to reconcile due to the breadth of subdiagnostic classifications, use of different diagnostic tools and outcome definitions; misclassifications; unreported disease; and/or data limitations.[52-56] Application of a concise set of subdiagnostic groups with consistent definitions in clinical work and clinical trials will improve the quality of data, thus providing more accurate and comparable rates of occupational contact dermatitis.[53]

The BOHRF guidelines, published in 2010, reported that the most reliable population estimates of incidence of occupational contact dermatitis are between 11.0 and 86.0 cases per 100,000 workers per year.[49,50]

A wide range of estimates has been reported from recent North American data.[52] A 2010 review of research published from 1982 to 2007, mainly from Sweden, Denmark, Finland and the Netherlands, reported a one-year median prevalence of hand eczema in the general population of 9.7% and a lifetime prevalence of 15.0%. The same authors reported a median incidence of 5.5 cases per 1,000 person-years.[47] Where subdiagnoses were available, irritant contact dermatitis was more prevalent than allergic contact dermatitis and diagnoses of irritant contact dermatitis and allergic contact dermatitis accounted for the majority of cases of hand eczema.[47]

HCWs are at high risk for occupational contact dermatitis, especially on their hands. This is likely due to repeated and lengthy exposure to wet work.[52] Wet work is defined as activities where workers have to immerse their hands in liquids for more than two hours per shift or wear waterproof (occlusive) gloves for a corresponding amount of time or wash their hands more than 20 times per shift.[16] Wet work is an exposure that can be difficult for HCWs to avoid. It has been reported that approximately 20% of those who work in wet-work occupations, which includes HCWs, have hand eczema.[57]

Ibler et al. surveyed 2,274 HCWs and reported a one-year prevalence of hand eczema of 21%, which is double the prevalence reported in the general population. Among HCWs in different roles, the prevalence for doctors, nurses, nursing auxiliaries and biotechnicians was 19% (58 of 302), 23% (233 of 1019), 19% (68 of 364) and 23% (38 of 167), respectively.[54]

Among HCWs, nurses are at particular risk for occupational contact dermatitis. Visser et al. prospectively followed 533 apprentice nurses for three consecutive years. Self-reported one-year prevalence of hand eczema was 23%, 25% and 31%, in years one, two and three, respectively; incidence was 85 per 1,000 person-years.[58] Schwensen et al. reported a higher incidence of severe occupational contact dermatitis in female nurses and nurse assistants versus males in those roles (3.4 versus 1.1 per 10,000 workers per year, respectively).[51]

When interpreting prevalence and incidence data, the healthy worker effect should be considered as a potential source of bias. McMichael first coined the term in 1976 and described “the consistent tendency of the actively employed to have a more favorable mortality experience than the population at large” and stated that this “effect” did not affect all groups equally, even in the same population. He recommended that “allowances needed to be made for this unequal effect in different age groups, races, causes for death, elapsed time periods of observation and even different work groups.”[59,60] Last et al. added in *A Dictionary of Epidemiology* that the severely ill and chronically disabled are ordinarily excluded from employment.[61] Occupational epidemiologists have included reduction of morbidity, not just mortality, in occupational cohorts when compared to the general population.[60]

Chowdhury et al. described the healthy worker effect as potentially both a selection bias and a confounder and noted several factors to consider in HCWs with occupational contact dermatitis:[60] time since hire or duration of employment, where the healthy worker effect wears off over time; age at hire, where younger people tend to be healthier than older people; and gender, with a stronger healthy worker effect seen in women as compared to men (HCWs are predominantly female). When HCWs are redeployed or leave their employment due to severe occupational contact dermatitis, the remaining active workforce appears “healthier” (i.e., fewer or milder cases of occupational contact dermatitis in the remaining workforce).

In some regions, the incidence of occupational contact dermatitis is declining, possibly owing to national programs aimed at addressing common irritant and allergic exposures in high risk occupations. The decrease may be specific for allergic contact dermatitis and not for irritant contact dermatitis.[56,57,62]

1.4 Workers at Risk

Agricultural workers (e.g., farmers), beauticians, chemical workers, carpenters, cleaners, construction workers, electronics workers, florists, food industry workers (e.g., bakers, caterers, cooks), hairdressers, HCWs, machine operators, mechanics, metalworkers, miners, painters, plastics and rubber workers, and vehicle assembly workers are all commonly reported to be at increased risk for occupational contact dermatitis.[16,50,51,56,63-65] Diepgen reported that nearly 80% of work-related skin diseases in Germany occurred in seven occupational groups: cleaners, construction workers, food industry workers, hairdressers, HCWs, metal workers and painters.[66]

Although HCWs do not have the highest occupational risk for occupational contact dermatitis, they are often overrepresented due to the large size of their workforce compared to other high-risk occupations.[46,51,67]

Development of occupational contact dermatitis appears to be independent of the number of years worked[16,49,50,56,65,68] and may occur at any point in a worker's career.[49,50] Some evidence suggests that in careers such as hairdressing, apprentices or individuals early in their career may be exposed to more wet work which puts them at greater risk compared to more experienced hairdressers. Consideration of risk of development of occupational contact dermatitis relies on factors such as tasks being performed, as well as on personal behaviours.[49,50]

1.5 Causative Agents in the Workplace

Causative agents vary by occupation. The most common skin irritants include alcohols, cutting oils and coolants, degreasers, disinfectants, petroleum products, soaps and cleansers, solvents and wet work.[49,50] Among HCWs the most common irritants are wet work, hand cleansers, cleaning agents, gloves, heat and perspiration.[46,56]

The most common skin allergens include metals (e.g., nickel, chromium, cobalt), cosmetics and fragrances, epoxies, plants, preservatives, resins and acrylics.[49,50] Among HCWs the most common allergens are natural rubber latex, rubber accelerators, preservatives, excipients in hand cleansers (additional ingredients in the cleansers that are unrelated to the active substances for hand cleansing), antiseptics and dental materials (e.g., metals, acrylates).[46,56,69]

As a result of multiple exposures in the workplace, allergic contact dermatitis and irritant contact dermatitis can coexist.[70,71]

The most common irritants and allergens encountered in seven high-risk occupations[66] are presented in Table 14. A list of irritants and allergens encountered in various occupations is presented in Appendix B.

Table 14. Irritants and Allergens Encountered in High-Risk Occupations

Occupation	Irritants	Allergens
Cleaners	Detergents, solvents, wet work	Preservatives (e.g., butylated hydroxytoluene), fragrances, rubber gloves†
Construction workers	Cement	Chromates, cobalt, resins, rubber and leather gloves, woods
Food industry workers	Detergents, flour, meat, vegetable juices, waste, wet work	Ammonium persulfate, benzoyl peroxide, dyes, essential oils, flavours, formaldehyde, garlic, lauryl and octyl gallate, lemon, nickel, onions, orange, rubber gloves,† sawdust from bones, sodium metabisulfite, spices
Hairdressers	Bleaching agents, permanent wave solutions, shampoos, wet work	Dyes, formaldehyde, nickel, fragrances, persulfates, preservatives (e.g., methylisothiazolinone), pyrogallol, resorcinol, rubber gloves†
Health care workers	Cleaning agents, detergents, disinfectants, foods, hand cleansers, heat, perspiration, wet work	Local anesthetics, antibiotics, antiseptics, dental materials, disinfectants, eugenol, excipients and fragrances in hand care products, formaldehyde, glutaraldehyde, preservatives (e.g., butylated hydroxytoluene), mercury, methacrylates (e.g., methylmethacrylate), liquid chloroxylenol, phenothiazines, rubber gloves†
Metal workers	Cutting oils, hand cleaners, solvents	Additives in some cutting oils, chromates, nickel
Painters	Hand cleansers, solvents, thinners, wallpaper adhesives	Adhesives, chromates, cobalt, epoxy resin, formaldehyde, paints, polyester resins, preservatives (e.g., methylisothiazolinone, methylchloroisothiazolinone), thinners, turpentine

†Natural rubber latex and rubber accelerators
Adapted from CCOHS[72,73]

1.6 Impact of Seasonal Changes in Weather

Seasonal variation in environmental conditions, such as temperature, humidity and ultraviolet light exposure can affect the skin. Dry skin (xerosis) is more prevalent in winter months in temperate climates due to exposure of the hands to cold, dry air and to large temperature variation between indoor and outdoor environments. Winter months are associated with changes in the constituents of natural moisturizing factors in the stratum corneum (elements that keep the outer layer of the skin protected and hydrated).[74] The effects of winter weather (low temperature and low relative humidity) are also associated with increased reaction to skin irritants, particularly in HCWs.[75,76]

In addition to improved skin hydration in the summer months, skin conditions may also improve through exposure to narrowband UVA and UVB. Low dose UVA and UVB exposure has been associated with improvement in skin barrier function.[75]

Overall, data from cohort and epidemiological studies regarding the impact of seasonal changes in weather on contact dermatitis are limited and further research is needed.[76]

1.7 Personal Risk Factors

Exposure to skin irritants and allergens in the workplace is the most significant independent risk factor for developing occupational contact dermatitis. The role of various personal risk factors in the development and exacerbation of occupational contact dermatitis is unclear. Possible personal risk factors include genetics (e.g., filaggrin mutations, fairness of skin, age), gender, occupational history (e.g., previous workplace exposures to irritants or allergens), medical history (e.g., history or active symptoms of atopic dermatitis; history of hand eczema, dry skin or hyperhidrosis), behaviours (e.g., frequency of hand washing at home or work, frequency and duration of glove use at home or work) and nonoccupational activities that result in exposures to known irritants or allergens (e.g., children at home under the age of four, food preparation, renovation, repairs to motor vehicles). The evidence in support of these risk factors is either conflicting or sparse.[7,16,52-54,63,74,77]

Atopic dermatitis (also known as atopic eczema) is a chronic inflammatory skin disease that is characterized by intense itching and recurrent eczematous lesions. Although atopic dermatitis most often starts in infancy, it is also highly prevalent in adults. Active atopic dermatitis and a history of atopic dermatitis, particularly in adulthood, are risk factors for the development of occupational contact dermatitis.[50,54,78,79]

On the other hand, the role of atopy in the development of occupational contact dermatitis is not clear. Atopy refers to the genetic tendency to develop allergic diseases such as allergic rhinitis, asthma and atopic dermatitis. Atopy is typically associated with heightened immune responses to common allergens, especially inhaled allergens and food allergens. There is conflicting evidence regarding the association between atopy and either irritant contact dermatitis or allergic contact dermatitis; thus, atopy is not currently considered to be a risk factor for their development.[49,50,65,78] (For additional information, see research question 1.)

1.8 Diagnosis

Diagnosing occupational contact dermatitis is complex and frequently results in misdiagnoses. A definitive clinical diagnosis can be complicated when there are other underlying dermatoses. It is important to make the correct diagnosis before initiating treatment or implementing any modifications in workplace exposures. Components of diagnosis include careful history taking and clinical examination.

Careful history taking requires skill and helps to inform the occupational relevance of presenting signs and symptoms. A complete history includes:

- date of onset of symptoms and anatomical location
- workplace exposures, including a list of all products and chemicals that are handled
- previous or current skin conditions
- previous work history with exposure to irritants or allergens
- workplace behaviours, including type(s) of duties performed, duration and frequency of glove use, and hand hygiene practices
- behaviours that can impact skin health, including hobbies, personal habits, and other nonoccupational activities that could result in exposures to irritants or allergens

Clinical examination can identify signs that are consistent with contact dermatitis. Depending on severity, these signs can range from dryness and mild erythema in mild contact dermatitis, to skin with erythema, weeping vesicles, cracking and fissures in severe contact dermatitis. Occupational contact dermatitis most commonly involves the hands, followed by wrists, forearms and face;[46,49-51] however, involvement of these areas can also be the result of nonoccupational causes.

There is no routine test or biomarker for irritant occupational contact dermatitis. For allergic contact dermatitis, HCWs presenting with skin complaints suggestive of allergic reactions may require confirmatory skin prick or patch testing, when appropriate. Results should be interpreted by a professional and in conjunction with work history and physical examination.

1.8.1 Skin Prick Testing

Skin prick testing, also called puncture or scratch testing, is used to check for immediate type I allergic reactions to allergens, such as latex, food proteins, animals and dust. A small amount of each substance is pricked or scratched onto the skin using a sterile needle (see Figure 5). These substances, called haptens, are incomplete antigens that are not immunogenic by themselves. Histamine, which always causes a reaction, and saline, which does not, are used as positive and negative controls, respectively. An allergy to one of the haptens will appear as a wheal-and-flare reaction on the skin. The wheal is a raised, itchy hive caused by the release of serum into the tissues and is surrounded by an area of skin redness, or erythema, resulting from the dilation of blood vessels (see Figure 6). The extent of the reaction is measured on a scale

of zero to four millimetres. A wheal that is three millimetres greater than negative control indicates an allergic reaction; and the larger the wheal and flare, the greater the sensitivity.

Figure 5. Skin Prick Testing

Figure 6. Wheal-and-Flare Reaction to Skin Prick Testing

(Image: Allergen skin test. Image source: CDC Public Health Image Library ID#15442. CDC/Dr. Frank Perlman, M.A. Parsons. Available from: https://phil.cdc.gov/Details.aspx?pid=15442. With permission.)

1.8.2 Skin Patch Testing

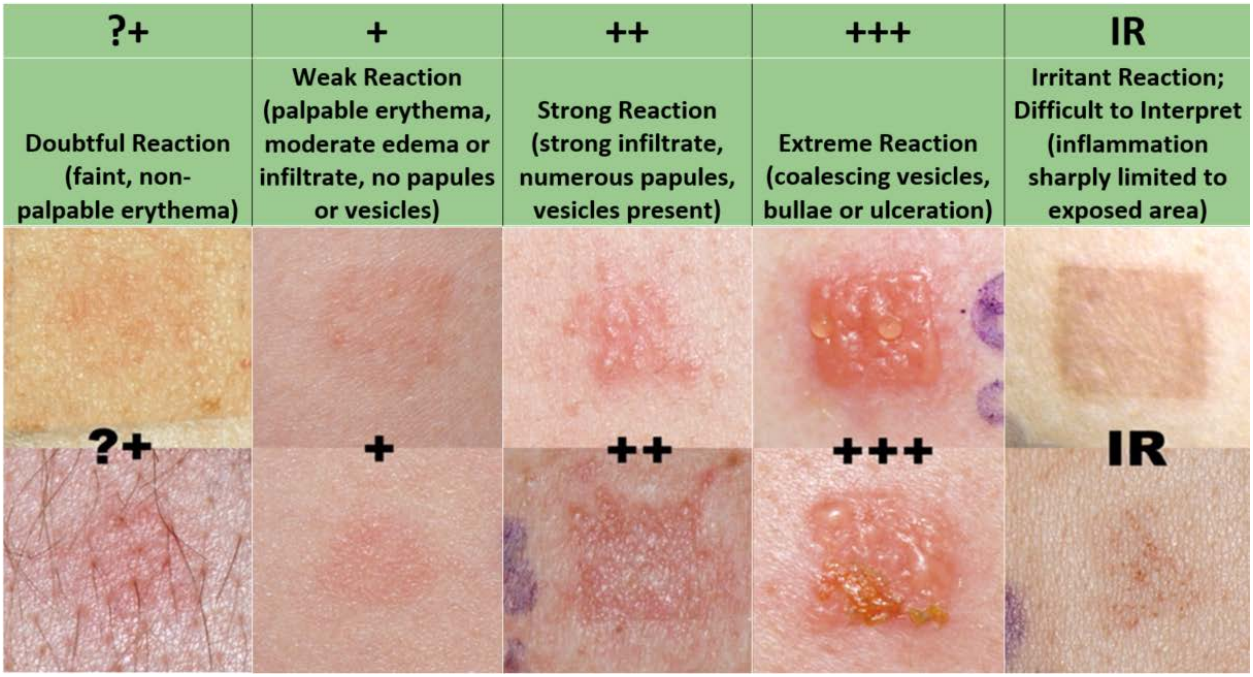
Skin patch testing, the gold standard for diagnosing allergic contact dermatitis, is used for identification of a type IV allergic reaction to various haptens. A patch test involves provoking skin inflammation on a very small area of the skin under controlled conditions. This is accomplished using standardized trays with small plastic or aluminum chambers. The haptens are diluted in petrolatum, water or alcohol and 0.5 cm is placed in a chamber. The chambers are placed on the patient's normal (no active dermatitis), dry back (see Figure 7) and removed at 48 hours when the preliminary reading is performed and recorded. The final or delayed reading is usually done at 96 or 120 hours. This late reading is critical for the correct interpretation of a delayed hypersensitivity reaction of allergic contact dermatitis. The back must remain dry for the entire testing period. Patients who have atopic dermatitis may develop irritant

reactions to patch test chemicals thus requiring a clinical expert to differentiate between irritant reactions and true allergic reactions.[42]

Figure 7. Skin Patch Testing

Skin patch test reactions are graded based on appearance, according to standards established by the International Contact Dermatitis Research Group, from no reaction (0) to extreme reaction (+++) (see Figure 8).[80]

Figure 8. Visual Key for Scoring Skin Patch Testing Reaction[40,81]



(Image source: Spiewak R. Patch testing for contact allergy and allergic contact dermatitis. Open Allergy J. 2008;1:42-51. Available from: https://openallergyjournal.com/contents/volumes/V1/TOALLJ-1-42/TOALLJ-1-42.pdf. Used with permission available from: https://openallergyjournal.com/editorial-policies.php).

There is a wide range of haptens available for skin patch testing, but the list is not exhaustive. In addition to a standard screening tray, it may be appropriate to test with additional haptens relevant to the health care environment. A review of agents and the safety data sheets should identify additional items for testing. These may include additional preservatives, disinfectants and glove-related haptens. If these are not available as commercial haptens, custom haptens may be used; however, this should be done in a patch test centre by physicians with expertise in custom patch testing.

Skin prick testing and patch testing may both be performed if latex sensitivity is suspected. Skin prick testing would demonstrate a type I, urticarial reaction to latex protein (if positive). Patch testing for rubber accelerators, such as thiurams and carbamates, would produce a type IV reaction (if allergic). (For additional information, see research question 2.)

1.9 Hand Hygiene Best Practices

Hand hygiene is a general term referring to any method of cleaning hands, usually with alcohol-based hand rub (ABHR) or soap and running water. Hand hygiene in health care settings relates to the removal or killing of transient microorganisms from the hands and the removal of visible soil. Hand hygiene is essential for infection prevention and control and is required practice for all HCWs.[82] ABHR is the preferred method for hand hygiene because it offers the highest reduction of microorganisms and is the least damaging to hands. ABHR with concentrations of 70% to 90% alcohol (ethanol or isopropanol volume per volume [v/v]) are recommended in health care settings. This concentration has been shown to kill nonenveloped viruses, such as norovirus.[83] The mechanism of killing microorganisms requires the concentration of alcohol to be less than 90% because some water is required to denature proteins.[84] Providing ABHR that contains emollients will help maintain skin health.

Washing with soap and water is used as the preferred method for hand hygiene when hands are visibly soiled or spore forming organisms (e.g., *Clostridioides difficile*) are suspected because ABHR is ineffective at removal of visible soil and has less killing activity for spore-forming organisms.

1.10 Occupational Contact Dermatitis as a Barrier to Hand Hygiene Best Practices

Hand hygiene is a requirement of good patient care (i.e., before initial contact with a patient or their environment, before an aseptic procedure, after body fluid exposure risk, and after contact with a patient or their environment); however, repeated hand hygiene can initiate or exacerbate occupational contact dermatitis in HCWs.[82] HCWs with underlying dermatitis (atopic, irritant or allergic) and nonintact skin have described stinging and burning with the use of ABHR that may lead to the perception that the ABHR is more damaging than the use of soap and water.[85-87] Inferring from the evidence, it is postulated that behavioural changes result in the continued use of soap and water that further exacerbate symptoms of occupational contact dermatitis. Contrary to HCW perceptions, according to experts in dermatology, ABHR is less damaging than soap and water except in cases of severe dermatitis. In these

severe cases, the HCW's work tasks should be modified to avoid the need to perform hand hygiene (i.e., minimize direct patient care).

It follows that a hand care program is absolutely necessary in health care settings to prevent and manage occupational contact dermatitis while maintaining compliance with hand hygiene best practices.

Although no literature was identified that compared hand hygiene compliance rates in HCWs with hand dermatitis compared to HCWs with normal skin, it is plausible that hand hygiene is performed less often by HCWs with damaged skin. Performing hand hygiene less often may improve the dermatitis symptoms, but result in a significant risk for the HCW to colonize or acquire an infection or to transmit microorganisms that could colonize or cause infections.

1.11 Elements of a Hand Care Program

The primary goal of a successful hand care program is to maintain and promote healthy, intact skin. Damaged skin increases the penetration of substances, including irritants and allergens, in the stratum corneum and can act as a reservoir for those substances.[88] Soap, water and other hand washing products often contain surfactants (detergents), which will remove dirt from the surface of the skin. Surfactants can also disrupt the lipid barrier in the stratum corneum and lead to skin dryness, redness and irritation.[89] Intact skin is also the body's first line of defence against colonization and infection.

Hand care programs include:

- hand care assessment, including skin screening
- skin health surveillance
- referral to Occupational Health for assessment if skin integrity is an issue
- education and training programs
- provision of hand moisturizing products
- provision of ABHR that contains an emollient

1.11.1 Skin Screening

Skin screening is an important aspect of hand care assessment used to identify HCWs at risk for occupational contact dermatitis through administration of a questionnaire and/or medical examination. Screening allows dermatitis to be detected before an individual would seek medical care, at a point when intervention would be beneficial. Positive screening tests may indicate the presence of occupational contact dermatitis or the strong likelihood of occupational contact dermatitis and the need for further assessment. The goal of medical screening is the secondary prevention of disease, i.e., the identification of disease at a stage when its progression can be reversed, arrested or slowed.[15] There are a variety of self-reported surveys that can be used for skin screening (see Appendix F). For example, the Nordic Occupational Skin Questionnaire (NOSQ) was specifically developed to survey work-related skin

conditions and environmental exposures.[90] The NOSQ-2002/LONG (long version) uses 57 questions aimed at both self-reported diagnosis and symptom-based diagnosis. The survey questions address: occupational history, atopic symptoms, self-reported hand or forearm eczema, exacerbating factors, consequences and life impact, skin symptoms, skin tests, exposures, protective glove use and general health. The long version is useful for epidemiologic purposes and to identify workplace or population risk factors for occupational skin diseases. The NOSQ-2002/SHORT (short version) includes 14 of the 57 questions and is designed to be used for screening and monitoring of occupational skin diseases on the hands and forearms of workers.[91]

If a self-reported survey determines that skin integrity is an issue, a clinical assessment would likely be performed by Occupational Health, if that service is available or by a physician. (For additional information, see research questions 9, 10, 11 and 12.)

1.11.2 Periodic Skin Health Surveillance

Periodic skin health surveillance is another important aspect of a hand care program. It includes the systematic ongoing collection, collation and analysis of health information; the evaluation and interpretation of these data (e.g., data from workers' compensation); and reporting of appropriate nominal or non-nominal data to those who require it in order to take action.[15] (For additional information, see research questions 9, 10, 11 and 12.)

1.11.3 Effective Education and Training Programs

Effective education and training programs are key to improving both the health and safety of HCWs and the health and safety of patients. Front-line HCWs who develop symptoms of occupational contact dermatitis can put themselves at risk for skin colonization or infection, as well as potentially put their patients at risk for infection through transmission of microorganisms. Without early detection of disease and timely intervention and management, the severity and chronicity of dermatitis can worsen, resulting in poor clinical outcomes, which negatively impact the quality of work and home life.

Education and training programs that are multimodal in nature and tailored to specific audiences have been shown to be effective. Provision of skin care resources, repeated offerings and organization-wide engagement are also associated with successful interventions.[92] In health care settings, it is also important for HCW education to include best practices for hand hygiene, knowledge of infection prevention and control, as well as recommendations for hand care.

Education and training can begin at the time of hire and orientation and, where applicable, can be reinforced at the bedside. Supervisors and managers have specific roles to play in ensuring that HCWs understand the hazards they are exposed to in the workplace; have the knowledge and training to prevent exposure, when possible; and understand safe handling (e.g., through correct use of personal protective equipment for the task). It is often the infection prevention and control professional who is the first to note a HCW with dermatitis or hear the complaints about a new hand hygiene product. Clear and open communication and collaboration between Infection Prevention and Control, and Occupational Health is helpful for the HCW.

1.11.4 Hand Moisturizing Products

Hand moisturizing products are an important part of hand care and can be effective in preventing occupational contact dermatitis. They work to restore the ability of the stratum corneum to absorb, retain and redistribute water and help to maintain the integrity and appearance of the skin. They are also recommended to treat dry skin and mild dermatitis.

The terms “emollient” and “moisturizer” are often used interchangeably; however, moisturizer ingredients include emollients, occlusive agents and humectants.

- Emollients are used to soften and smooth (moisturize) the scales of the skin, thus reducing rough, flaky skin. Emollients include vegetable oils, butters and fatty alcohols.
- Occlusive agents provide a layer of protection to help prevent moisture (water) loss from the skin. Petrolatum and petrolatum derivatives (e.g., petroleum jelly, mineral oil) are occlusives commonly used in moisturizers. Some occlusives, such as dimethicone and cyclomethicone, also have emollient properties.
- A humectant is a substance that bonds with water molecules to increase the water content in the skin itself. This can be done by absorbing water from a humid environment or from the outer layer of the skin. Glycerin is a common and effective water-binding agent. Other humectants include sugars (e.g., glucose, fructose, sucrose, honey), urea, proteins, amino acids, elastin and collagen. Many humectants also have emollient properties, while not all emollients are humectants.

The best moisturizers have a combination of emollients and humectants. See Table 15 for a description of emollients, humectants and occlusives.

Table 15. Description of Emollients, Humectants and Occlusives[93-95]

Product	Mechanism of Action	Ingredients	Additional Information
Emollients	Enhance skin hydration by replacing lost water. Improve the texture and appearance of the skin, making it smoother and more flexible.	Butters (e.g., cocoa butter, shea butter) Cholesterol Fatty acids Fatty alcohols Pseudoceramides Squalene Vegetable oils (e.g., grape seed, sesame seed, jojoba)	Also often referred to as moisturizers, regeneration creams and conditioning creams. Properly formulated ABHR contains emollients to help hydrate the skin and maintain healthy skin.
Humectants	Bond with water molecules to increase water absorption from the outer layer of the skin and from the environment in humid conditions. Penetrate stratum corneum; their low molecular weight and ability to attract water help to draw water from the dermis and retain it in the epidermis.	Alpha hydroxy acids Glycerine Glycerol Hyaluronic acid Panthenol Propylene glycol Glycolic acid Sorbitol Urea Lactic acid	Many humectants also have emollient properties.
Occlusives	Form an inert layer (e.g., layer of oil) on the skin to physically block transepidermal water loss.	Beeswax Lanolin Mineral oil Petrolatum Silicones (e.g., dimethicone, cyclomethicone) Zinc oxide	Most effective on slightly dampened skin.

Hand moisturizers are available as lotions, creams and ointments, based on the amount of oil and water they contain. In general, more oil in a moisturizer improves moisture retention. The choice of moisturizer type depends on the condition of the skin.

- Lotions have a greater percentage of water than oil, making them thinner in consistency, easier to spread and more quickly absorbed. They may contain alcohols which prevent separation of the oil and water.[96] Lotions are reasonably hydrating and work well for weeping skin areas.

- Creams are typically formulated with equal parts water and oil and tend to be less greasy and lighter than ointments. While creams are generally beneficial to those with normal and dry skin, they may contain stabilizers or preservatives that can irritate skin or cause allergic contact reactions.

- Ointments are the thickest of the three, made primarily with 80% oil and 20% water. Ointments form a barrier that helps retain skin moisture and are recommended for extremely dry skin and for treating mild dermatitis.[93]

In addition to their active ingredients, emollient hand creams and lotions contain excipients (e.g., emulsifiers, antioxidants and/or preservatives) and many combine emollients, humectants and occlusives.

It has been suggested that barrier creams (also called prework creams, skin protective creams, antisolvent gels, protective ointments, shielding lotions or invisible gloves) place a barrier between the skin and irritating substances to inhibit or delay their penetration. Barrier creams are typically used in industrial settings and are generally not recommended for use by HCWs in health care settings. (For additional information, see research questions 12, 16 and 18.)

Properly formulated ABHR contains emollients to help hydrate the skin and maintain healthy skin. (For additional information, see research questions 13, 15, 18 and 20.)

1.12 Glove Use

Selection and use of gloves intersect with occupational contact dermatitis, Routine Practices and best practices for hand hygiene (see Box 1). Glove use includes glove liners (e.g., inner gloves when double gloving or cotton glove liners). With respect to occupational dermatitis, correctly selected gloves for the task may be used for protection against environmental exposures that can initiate or exacerbate irritant or allergic contact dermatitis. Appropriate technique for doffing (removing) gloves must be followed to prevent exposures to chemicals that may sensitize or irritate the skin. Glove material may also act as an agent of exposure (e.g., gloves with rubber accelerators causing allergic contact dermatitis or prolonged occlusive glove use causing irritant contact dermatitis). HCWs who are allergic to a component in a commonly-recommended glove should be provided with an alternative that does not contain the allergen. Routine Practices dictate that gloves be used by HCWs based on risk assessment related to infection control—when it is anticipated that their hands will be in contact with mucous membranes, nonintact skin, tissue, blood, body fluids, secretions, excretions or equipment and environmental surfaces contaminated with the above.[97]

Best practices for hand hygiene emphasize that gloves do not replace the need for hand hygiene, yet failure to perform hand hygiene before donning (putting on) and after doffing (removing) gloves or inappropriately performing hand hygiene while wearing gloves remains an ongoing issue.[82] Where glove use is indicated, HCWs should also thoughtfully select the appropriate type of glove (e.g., cuff length, glove thickness, glove material). Overuse of gloves can be avoided by only using them when indicated by a risk assessment. A summary of Routine Practices for glove use is presented in Box 1.

In summary, when gloves are required, correct glove use, including appropriate selection, proper application and safe removal, is essential. Gloves should be intact and clean and dry inside; and hands must be clean and dry when donning gloves.

Box 1. Routine Practices for Glove Use

Routine Practices for glove use include:

- Perform a risk assessment to determine if glove use (including glove liners) is indicated.
- Select gloves appropriate to the task.
- Wear the correct size of gloves.
- Perform hand hygiene before putting on gloves (including glove liners) for a clean/aseptic procedure.
- Put on gloves immediately before the activity for which they are indicated.
- Remove and discard gloves (including glove liners) immediately after the activity for which they were used.
- Perform hand hygiene immediately after glove removal.
- Change or remove gloves (including glove liners) if moving from a contaminated body site to a clean body site within the same patient.
- Change or remove gloves (including glove liners) after touching a contaminated site and before touching a clean site or the environment.
- Do not wash or reuse gloves.
- Never use the same pair of gloves or glove liners for the care of more than one patient.

(Adapted from: Ontario Agency for Health Protection and Promotion, Provincial Infectious Diseases Advisory Committee. *Routine practices and additional precautions in all health care settings*. 3rd edition. Toronto, ON: Queen's Printer for Ontario; November 2012.[97])

The type of glove selected is based on a risk assessment of the anticipated tasks and exposures to be performed. Glove material, durability, thickness and fit can vary. Criteria for selection should be based on setting, likelihood of exposure to blood or body fluids, anticipated length of use, stress that will be placed on the glove,[98] penetration time of substances and need for optimal tactility.

For example:

- Most patient care activities require the use of disposable, nonsterile gloves made of vinyl or nitrile.
- Sterile gloves are required for sterile procedures.
- Nitrile or neoprene gloves are recommended for protection against cleaning agents.
- Chemotherapy gloves are manufactured according to ASTM International Standards to ensure safe handling of chemotherapeutic drugs.

In the late 1990s and early 2000s, latex allergy became recognized as a major health concern for HCWs worldwide.[99,100] Allergy to natural rubber latex gloves is usually a type I, immediate hypersensitivity reaction that can range from mild skin erythema to anaphylaxis and even death. As a result, there has been a move away from using latex gloves in favour of nonlatex gloves, whenever possible.[101] Powdered latex gloves are particularly hazardous since the powder can transfer the latex allergen to the skin, thereby enabling sensitization.[102] If latex gloves cannot be replaced, they should be low protein and powder-free. Concurrent use of petroleum- or mineral-based skin care products can negatively affect the integrity of latex gloves by causing significant deterioration.[103]

Long-term use of occlusive gloves can have a negative effect on skin barrier function.[104] It has been suggested that wearing cotton glove liners under gloves helps to maintain skin barrier function. Cotton glove liners provided in health care settings are most commonly single use (disposable). Cotton glove liners that are classified as reusable should be changed between each use and reprocessed according to manufacturer's instructions. (See research questions 22 and 23, and Appendix A, Appendix C, Appendix D and Appendix E for more information on the appropriate selection and use of gloves and cotton glove liners.)

1.13 Hand Hygiene Best Practices and Glove Use Based on Severity

Specific recommendations for hand hygiene, glove use and patient care vary with the severity of occupational contact dermatitis (Table 16). For example, in HCWs with moderate to severe dermatitis (dryness, erythema, cracking, scaling and weeping vesicles), glove use should be avoided by removing HCWs from direct patient care (workplace modifications).

The regular use of emollient hand lotions or creams should be reinforced with all HCWs. HCWs with dermatitis may find products containing alcohol cause stinging and irritation. Soap and water can be an acceptable alternative. Workers with more severe dermatitis should avoid wet work activities and may

need temporary work accommodation (e.g., away from patient care). These HCWs should be properly assessed through the occupational health service or by those designated to provide clinical assessment (e.g., family physician).

Table 16. Workplace Hand Hygiene and Glove Use in Health Care Workers Based on Severity of Dermatitis

Skin Condition[‡]	Hand Hygiene	Glove Use	Patient Care
Normal skin	ABHR preferred ABHR with emollients moisturizes skin	Follow Routine Practices and Additional Precautions[§]	No work restrictions Hand hygiene in alignment with patient care needs
Mild dermatitis	ABHR preferred ABHR with emollients moisturizes skin	Follow Routine Practices and Additional Precautions[§]	No work restrictions Hand hygiene in alignment with patient care needs
Mild to moderate dermatitis	ABHR preferred ABHR with emollients moisturizes skin	Cotton glove liners may be used and glove use follows Routine Practices and Additional Precautions[§]	No work restrictions Hand hygiene in alignment with patient care needs
Moderate dermatitis	Soap and water preferred ABHR can be stinging	Cotton glove liners are recommended and glove use follows Routine Practices and Additional Precautions[§]	Limit direct patient care Hand hygiene requirements for patient care are met with soap and water
Moderate to severe dermatitis	Wash hands with soap and water	Minimize or avoid glove use	Remove from direct patient care
Severe dermatitis	Wash hands with soap and water	Avoid glove use	Remove from direct patient care

Abbreviations: ABHR = Alcohol-based hand rub

[‡]See Appendix A for skin condition definitions.

[§] Ontario Agency for Health Protection and Promotion (Public Health Ontario), Provincial Infectious Diseases Advisory Committee. *Routine practices and additional precautions in all health care settings*. 3rd ed. Toronto, ON: Queen's Printer for Ontario; 2012.

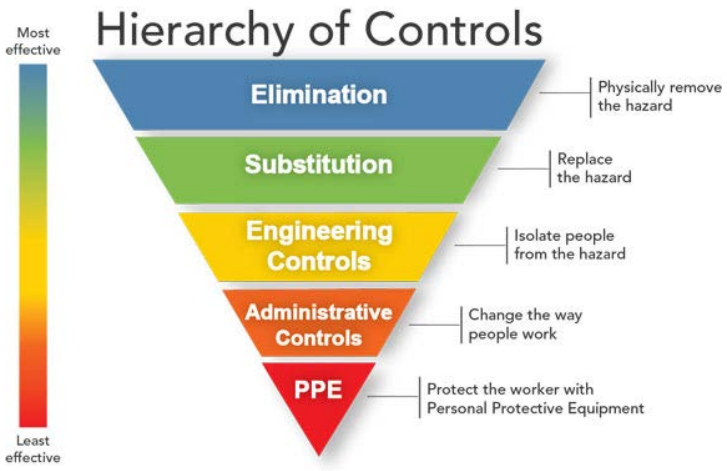
1.14 Hierarchy of Controls

Occupational health and safety professionals often refer to the hierarchy of controls, which ranks exposure control measures from the most to the least effective (Figure 9). This conceptual framework can be applied to the control of exposures relevant to occupational contact dermatitis:[105]

- Elimination of the source of the exposure (e.g., changing soap formulation to remove triclosan, a known irritant).
- Substitution with a different substance or process (e.g., changing from latex gloves to nitrile gloves).
- Engineering controls address the design of the workplace to reduce exposures (e.g., providing ABHR at point-of-care and emollient hand creams in multiple, easily-accessible locations).
- Administrative and work-practice controls include the policies, procedures, education, training and patient care practices that are intended to change the way people work.
- Personal protective equipment, such as gloves and cotton glove liners. The role of personal protective equipment becomes less important when other more effective controls are available.

Some measures to control exposures are more effective than others and the feasibility and applicability of each one depends on many factors. The overall goal of these controls is to minimize harm by protecting HCWs and their patients. Multifaceted programs involving more than one exposure control measure are common in health care settings, making it difficult to determine the relative effectiveness of individual measures.

Figure 9. Hierarchy of Controls



(Image: Hierarchy of controls. Source: National Institute for Occupational Safety and Health (NIOSH). Hierarchy of controls [Internet]. Atlanta, GA: Centers for Disease Control and Prevention; 2015 [cited 2019 Jan 9]. Available from: https://www.cdc.gov/niosh/topics/hierarchy/default.html. Used with permission.)

1.15 Primary Prevention

Primary prevention aims to prevent occupational contact dermatitis before it occurs.[14] Since occupational contact dermatitis results from direct contact of a substance with the surface of the skin, controlling exposure to the offending irritant or allergen is the most effective preventive measure. Elimination which physically removes the hazard, or substitution which replaces the hazard, are the preferred controls. Engineering controls, administrative controls and personal protective equipment also have important roles to play in primary prevention. (See also 1.14 Hierarchy of Controls.)

For HCWs, personal risk assessment is an important part of Routine Practices to prevent occupational contact dermatitis. Following hand hygiene best practices to keep the skin intact can also help to prevent occupational contact dermatitis.

1.16 Secondary Prevention

Secondary prevention aims to reduce the impact of occupational contact dermatitis that has already developed.[14] This is done by detecting and treating occupational contact dermatitis as soon as possible (to halt or slow its progress); encouraging personal strategies at work and home to prevent recurrence; and implementing programs to return people to their original health and function (to prevent long-term problems).

Early diagnosis of occupational contact dermatitis is important for secondary prevention. Proper diagnosis will inform the management of individual HCWs. It is important to confirm that the presenting skin disorder is dermatitis, to ascertain whether the dermatitis is work related, and to distinguish between irritant and allergic occupational contact dermatitis. Mathias proposed objective criteria to form a framework for the correct identification of occupational contact dermatitis, such that occupational origin is considered likely when four of the seven criteria are present:[40]

- clinical appearance consistent with contact dermatitis
- workplace exposure to potential cutaneous irritants or allergens
- anatomical distribution consistent with cutaneous exposure related to the job
- temporal relationship between exposure and onset consistent with contact dermatitis
- nonoccupational exposures excluded as likely causes
- removal from exposure leads to improvement of dermatitis
- patch or provocation tests implicate a specific workplace exposure

1.17 Tertiary Prevention

While the prognosis of occupational contact dermatitis is quite variable, workers with occupational contact dermatitis often have adverse outcomes that impact their overall quality of life and may result in significant work disruption. Tertiary prevention aims to prevent impairment and disability in a worker who has developed occupational contact dermatitis by using medical management and appropriate workplace interventions, as well as prevention and control strategies, as appropriate, in the work and home environments.[14,106]

1.18 Treatment

The importance of skin protection and education programs to prevent the development of contact dermatitis, and the need to avoid continued exposure to offending allergens or irritants cannot be overemphasized. Once diagnosed, contact dermatitis should be treated actively and quickly to prevent development of chronic dermatitis.[107] Specific treatment recommendations are out of scope for this document and are provided for information only.

Treatment options for occupational contact dermatitis include topical, systemic and physical therapies.[108,109] The causes of occupational contact dermatitis are often multifactorial and treatment decisions should consider the type of occupational contact dermatitis (i.e., atopic, allergic, irritant), acuteness (acute versus chronic), severity of presenting signs and symptoms (redness, scaling, blistering, etc.) and anatomical location (e.g., dorsal aspects of hands, interdigital spaces, palms).[107,110]

Despite decades of clinical practice using multiple medical therapies, there are very few randomized controlled trials and little evidence to support specific interventions.[107] Clinical management, including the use of oral and/or physical agents should be guided and monitored by experts with the appropriate knowledge and experience.

The combined use of topical corticosteroids and emollients is the mainstay of first-line therapy for contact dermatitis. Mild eczema may respond to over-the-counter topical steroid preparations (e.g., hydrocortisone 1% cream or ointment); however, higher strength corticosteroid prescription treatments (e.g., mometasone furoate) may be required for moderate to severe dermatitis. Since prolonged use can result in significant side effects (e.g., thinning of the skin), treatment with corticosteroids should be closely managed by a physician with relevant knowledge and expertise.

Alternative treatments for persistent dermatitis may include nonsteroidal anti-inflammatory ointments (e.g., crisabarole) or calcineurin inhibitors (e.g., tacrolimus). When localized skin treatment fails, oral corticosteroids, such as prednisone, can be effective in the short term.

Alitretinoin, an oral, vitamin A derivative, may be prescribed for severe occupational contact dermatitis. It has both immunomodulating and anti-inflammatory properties; however, it is teratogenic. Potent immunosuppressants, such as cyclosporine, methotrexate or mycophenolate mofetil, have also been used to treat severe occupational contact dermatitis; but, there is no evidence base to support their use and they can also be teratogenic.[107,110]

Physical therapies, such as psoralen-UVA (PUVA) photochemotherapy and local narrowband UVB (NB-UVB) phototherapy, are used for treating chronic dermatitis.[111] NB-UVB can be used safely and effectively and is usually the first choice for phototherapy.[112]

New products and therapies are always in development, as are new indications for treatment with existing medications and reporting of new adverse effects. It is important to remain prudent and ensure that treatment recommendations are current and consistent with guidance from recognized bodies of expertise.

1.19 Workplace Interventions

Keeping HCWs in their original or modified roles and returning them to work is challenging and depends on many factors. Legislation governing workplace interventions is provided in the *Occupational Health and Safety Act*, as well as through provincial human rights and workers' compensation legislation.[17,113-115] Reasonable control of symptoms and avoidance of occupation change, job loss or retirement may be possible in some workplaces; however, when occupational contact dermatitis is more severe, significant workplace modifications and redeployment may be required (Table 17).

Workplace modifications mean that HCWs remain in their current job, but have tasks modified in order to control or avoid exposures that have caused or aggravated their irritant contact dermatitis or allergic contact dermatitis. These modifications can include reducing the number of hours of patient care provided, changing the type of gloves used or changing skin care practices.[116] Attempts should be made to accommodate a HCW in their own job using workplace modifications before considering redeployment.

A HCW who develops moderate to severe occupational contact dermatitis may be temporarily or permanently redeployed (i.e., reassigned) to other departments or jobs within the organization as an alternative to layoff. This occurs when a job can no longer be adequately accommodated or modified for the health and safety of the individual. Workplace modifications, redeployment to a low-exposure area, or the introduction of exposure controls, may lead to improvement or resolution of occupational contact dermatitis in some workers, but these are not always effective solutions. Redeployment may become permanent if resolution of occupational contact dermatitis cannot be achieved. (For additional information, see research questions 22 and 23.)

Table 17. Recommendations for Work Restrictions and Patient Care Based on Severity of Dermatitis

Normal Skin‡	Mild Dermatitis‡	Mild to Moderate Dermatitis‡	Moderate Dermatitis‡	Moderate to Severe Dermatitis‡	Severe Dermatitis‡
No work restrictions Hand hygiene in alignment with patient care needs	No work restrictions Hand hygiene in alignment with patient care needs	No work restrictions Hand hygiene in alignment with patient care needs	Limit direct patient care Hand hygiene requirements for patient care are met with soap and water	Remove from direct patient care	Remove from direct patient care

‡ See Appendix A for skin condition definitions and additional considerations for infection prevention and control.

1.20 Clinical Prognosis and Impact on Workers

Occupational contact dermatitis carries significant consequences for workers, both in terms of their quality of life and ability to perform their job. Poor prognosis can negatively impact health-related quality of life and result in prolonged sick leave and unemployment. Even when causative agents have been removed, occupational contact dermatitis can become chronic—with long-lasting or permanent, medical, occupational, social and economic consequences.[117]

Early identification of workers with occupational contact dermatitis who are at greater risk of poor outcomes could be useful in guiding risk management strategies and treatment options. Determining the role of various factors in clinical prognosis could help in early identification. Research in this area has investigated quality of life at baseline, severity of occupational contact dermatitis, age, gender, socioeconomic status, atopy and contact allergies as possible risk factors for poor prognosis. (For additional information, see research questions 26 and 27.)

1.21 Infection Prevention and Control

Over 170 years ago, Ignaz Semmelweis presented evidence, for the first time, that cleansing contaminated hands with an antiseptic solution prior to examining mothers in labour reduced the incidence of puerperal fever and greatly improved patient outcomes.[118,119] Semmelweis, affectionately referred to as the "father of infection control," was a leader in infection prevention and control practices that remain essential today in reducing infection transmission risk and increasing patient safety.

Normal skin is colonized by a collection of microorganisms that include bacteria, fungi and viruses. Microorganisms that reside on the skin are called resident flora or resident microbiota. Resident

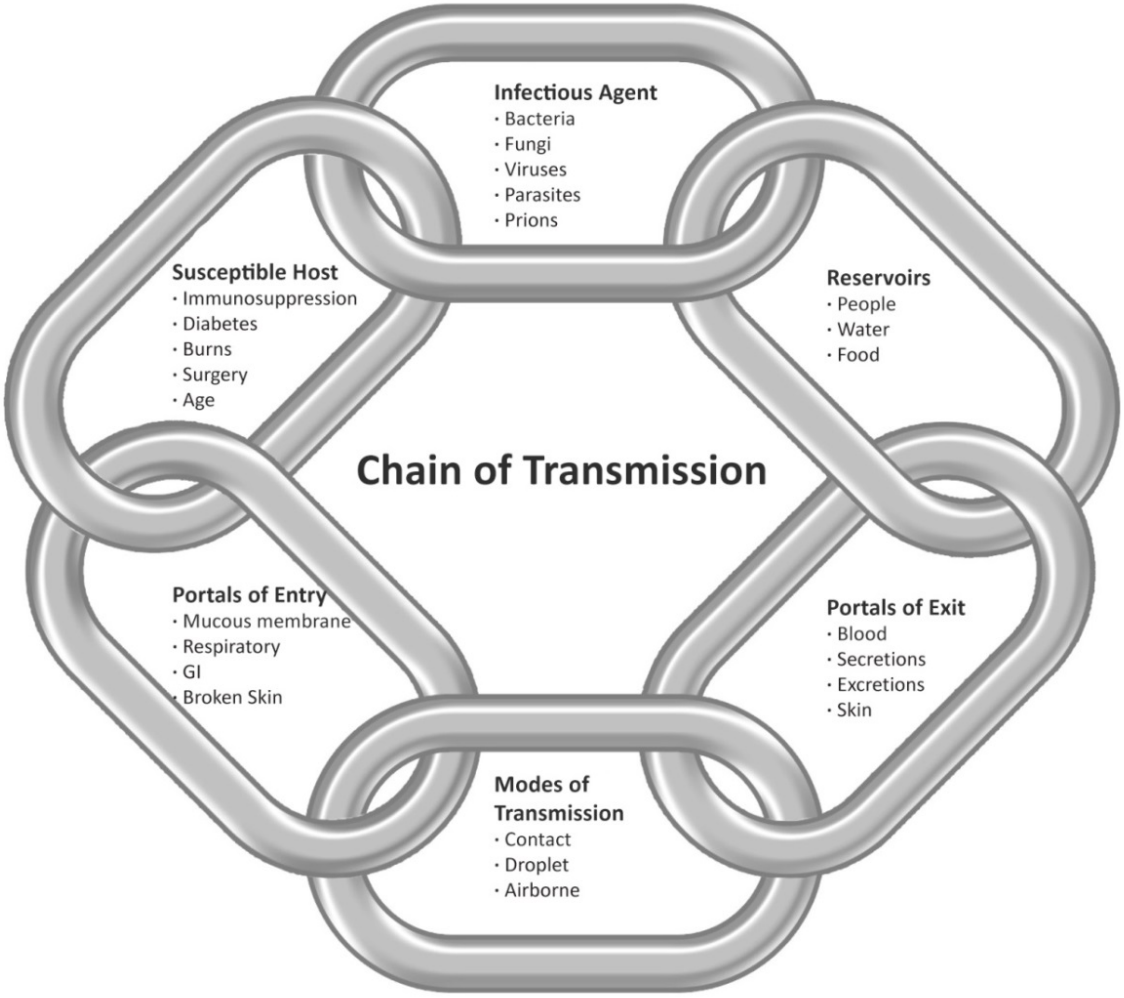
microbiota have a symbiotic function in humans, but they also can be opportunistic infectious agents if the barriers between microbiota and sterile sites are compromised (e.g., through skin lesions), or lead to contamination of products during sterile preparations (e.g., compounding medications).

Transient flora (transient microbiota) are microorganisms that are not normally present on the skin of healthy individuals (e.g., *Clostridioides difficile*). HCWs are exposed to transient microbiota through direct contact with patients or with contaminated environmental surfaces. Microorganisms can survive on hands for a variable length of time and the superficial layers of the skin on the hands of HCWs become progressively colonized with these transient microorganisms during sustained periods of patient contact.

Health care–associated infections are associated with significant burden in terms of morbidity, mortality, length of stay and health costs.[120] Hand hygiene, aimed at removing transient flora and reducing resident flora,[121,122] can decrease the risk of transferring microorganisms to patients through direct contact during the delivery of care. Although the transfer of microorganisms may not lead to health care–associated infections, it increases the reservoirs of potentially infectious microorganisms.

The transmission of infection in health care settings is often represented by a chain, where each link in the chain represents an element that is required in order for transmission to take place (Figure 10). Transmission occurs when an infectious agent (e.g., bacteria, fungi, viruses, parasites) in a reservoir (e.g., people, water, food), exits the reservoir through a portal of exit (e.g., blood, secretions, excretions, skin), travels through a mode of transmission (e.g., contact, droplet, airborne) and gains entry through a portal of entry (e.g., mucous membrane, respiratory, gastrointestinal, broken skin) to a susceptible host.

Figure 10. Chain of Transmission



(Image source: Ontario Agency for Health Protection and Promotion, Provincial Infectious Diseases Advisory Committee. *Routine practices and additional precautions in all health care settings*. 3rd edition. Toronto, ON: Queen's Printer for Ontario; November 2012.[97])

Infection prevention and control measures are aimed at breaking the chain so that transmission does not occur. HCWs must assess the risk of exposure to blood, body fluids and nonintact skin, and identify the strategies that will decrease exposure risk and prevent the transmission of transient microorganisms. Consistent and appropriate use of Routine Practices will lessen this transmission.[97]

HCWs with dermatitis can be at an increased risk of acquiring colonizing microorganisms because the normal skin defenses are disrupted. In addition, HCWs with dermatitis might be more likely than their peers to transmit microorganisms to patients if their skin lesions become colonized. (For additional information, see research questions 28 and 29.)

2. Research Evidence and Recommendations

The research questions are organized into eight main categories:

- risk assessment (section 2.1)
- elimination or substitution (section 2.2)
- administrative and work-practice controls (section 2.3)
    - education and training (section 2.3.1)
    - skin screening and surveillance (section 2.3.2)
    - hand hygiene best practices (section 2.3.3)
    - redeployment and workplace modifications (section 2.3.4)
- personal protective equipment (section 2.4)
- clinical diagnosis (section 2.5)
- clinical prognosis (section 2.6)
- impact on workers (section 2.7)
- infection prevention and control (section 2.8)

For each research question, evidence retrieved from the literature review is presented. Efforts were made to avoid presenting the same evidence more than once across multiple research questions. For a given research question, reference is often made to other research questions, since recommendations were often informed by evidence from multiple research questions. As a result of this method of organization, the same recommendation will appear under each research question that informed the recommendation.

See Summary of Research Questions for a complete list of the research questions. The full list of ODHCC recommendations and the approach used to grade them is found in Summary of Recommendations.

2.1 Risk Assessment

In addition to the risk assessment associated with Routine Practices, personal risk factors may play a role in the development of occupational contact dermatitis. Health care workers (HCWs) who have occupational contact dermatitis are also at risk for exacerbation of their condition.

Research Question 1: What personal factors could be measured at preplacement to better inform the management of risk for occupational dermatitis?

This research question was put forth in the 2009 RCP Guidelines as a priority for future guideline development.[123,124]

Self-screening skin assessments are commonly performed as part of routine occupational health practices at the time of hire (i.e., at preplacement). These assessments collect information related to skin health (e.g., skin integrity), pre-existing skin conditions based on history or self-examination, previous occupational exposures, allergies (e.g., cleaning agents, latex), glove use and hand hygiene techniques.

The goal of the skin assessment is to provide a baseline skin status to identify opportunities for education and training where gaps in knowledge are uncovered, or to identify pre-existing skin disease that may be exacerbated by skin irritants. If dermatitis is identified, appropriate follow-up can be arranged and work modifications can be discussed if required. It is not clear which personal factors could be measured in these preplacement assessments in order to manage occupational contact dermatitis risk in HCWs.

Based on a lack of an evidence base, recommendations on personal factors that could be measured at preplacement to better inform the management of risks for occupational contact dermatitis are not possible at this time.

2.2 Elimination or Substitution

Research questions in this section address elimination and substitution, the most effective methods in the hierarchy of exposure control.

Research Question 2: Is the incidence of occupational contact dermatitis reduced by controlling exposure through elimination or substitution?

This research question was included in the BOHRF Guidelines.[49,50] Based on a systematic review, the BOHRF Guidelines found that substitution reduces the incidence of occupational contact dermatitis and urticaria.[49,50] Specifically, substitution of powdered latex gloves with powder-free, low protein latex gloves reduced the incidence of occupational contact urticaria.[49,50] Outside of health care, occupational contact dermatitis incidence was significantly reduced in cement workers by adding ferrous sulfate to the cement manufacturing process to chelate chromate, thus reducing the exposure of workers to water-soluble chromates.[49,50]

The current literature search did not identify updated evidence; the recommendation put forth in the BOHRF Guidelines was accepted by the occupational dermatitis in health care committee (ODHCC) with slight modifications.

> **Recommendation:**
>
> 8. Employers should implement strategies to eliminate or reduce exposure to agents that cause occupational contact dermatitis. (Rating IIA; research question 2)

Research Question 3: Does avoidance or control of exposure lead to improvement or recovery?

This research question was included in the BOHRF Guidelines.[49,50] The BOHRF Guidelines presented evidence that continued exposure to allergens or irritants causing occupational contact dermatitis prevents improvement of symptoms and recovery, and that avoidance or control of exposure to relevant irritants and allergens can be effective in improving or resolving occupational contact dermatitis in some workers.[49,50] On the other hand, there is evidence that occupational contact dermatitis may persist even when the avoidance of allergens or irritants takes place over years. This phenomenon has been reported for allergic contact dermatitis to chromate and other metal salts.[49,50] Therefore, the nature of the allergen or irritant must be taken into account when considering whether avoidance of further exposure will lead to symptom improvement or recovery. Factors that may also be associated with a poor prognosis include older age, atopy, duration of symptoms and severity at diagnosis.[49,50]

Improvement in symptoms and management of occupational contact dermatitis has been reported when either correct selection and proper use of protective gloves or job modifications was used to limit exposure.[68,125-128] However, extensive glove use can also be a source of irritation. With respect to glove allergy, in a systematic review of latex allergy, occupational contact urticaria was reported to be significantly reduced following a change from powdered to powder-free latex gloves.[49,50] Two studies reported that skin disease prevalence and severity were only reduced when both avoidance practices and protective glove use were implemented.[68,128]

Job modifications have also been used as part of multifaceted, return-to-work programs in order to reduce exposure in HCWs. Chen et al. studied the impact of return-to-work programs aimed at reducing exposure through job modifications in 18 nurses with irritant hand dermatitis.[126] The nurses were performing either patient care activities with modifications or administrative duties only. The graduated return-to-work program included skin care management, physician monitoring, and monitoring by a return-to-work coordinator. The job modifications were deemed to have been successful—at the end of the program, 14 nurses had returned to their original patient care functions, three were working as nurses but not providing patient care, and one was on permanent disability.

Wet work is an exposure that can be difficult for HCWs to avoid. Clemmensen et al. investigated the impact of a one-hour workplace education program on knowledge and behaviours relevant to skin protection, and on skin symptoms in 86 hospital cleaners.[127] Eleven per cent of the cleaners had self-

reported hand eczema. Three months after the educational intervention, fewer cleaners were exposed to wet work for more than five hours per day, there were significantly fewer hand washings, and skin severity scores improved. Thus, avoiding or controlling wet work exposure did appear to lead to improvements in these HCWs. In practice, reducing wet work may not be feasible from an infection prevention and control perspective, and some HCWs may not have the option to reduce wet work exposure in order to perform their required daily tasks.

The current literature search identified updated evidence that was consistent with the recommendations put forth in the BOHRF Guidelines (see also research questions 20 and 26). The BOHRF recommendation was accepted with minor modifications.

> **Recommendation:**
>
> 2. If the diagnosis is uncertain or the dermatitis is persistent despite clinical assessment and treatment by the health care practitioner, then the health care worker should be assessed by a physician with expertise in occupational contact dermatitis for recommendations regarding appropriate medical treatment and workplace modifications. (Rating IIIB; research questions 3, 20 and 26)

2.3 Administrative and Work-Practice Controls of Exposure

Research questions in the current section address administrative and work-practice controls, including education and training, skin screening and surveillance, hand care programs and hand hygiene best practices. These controls can be implemented, in addition to more effective methods in the hierarchy of exposure controls (i.e., elimination, substitution or engineering controls), to try to mitigate the harmful effects of wet work and other irritant or allergen exposures.

2.3.1 Education and Training

Research Question 4: Do education and training programs help prevent the development of occupational contact dermatitis?

This research question was included in the BOHRF Guidelines.[49,50]

Evidence-based recommendations for the prevention of occupational contact dermatitis do exist but are not always followed in practice. Education about hand hygiene best practices for prevention of occupational contact dermatitis, and how to recognize the early signs of occupational contact dermatitis, are elements of many hand care programs. Based on a systematic review, the BOHRF Guidelines found that education and training programs can reduce the incidence of occupational contact dermatitis.[49,50]

Heron reported that training materials, such as video and poster presentations, were an important adjunct to other prevention and control measures in reducing dermatoses.[129] More recently, Van der Meer et al. delivered a multifaceted program to implement guideline-based recommendations aimed at preventing hand eczema among HCWs at three university hospitals in the Netherlands.[130] The education and training interventions included: working groups to identify problems with implementation, role models to help workers implement the recommendations, education for all workers, periodic reminders and distribution of an educational leaflet. Data were collected using self-reported questionnaires at 3, 6, 9 and 12 months following randomization to either the control (educational leaflet only) or the intervention group. The implementation strategy was effective in improving knowledge and awareness for the prevention of hand eczema.

The current literature search identified updated evidence relevant to the recommendation put forth in the BOHRF Guidelines. The BOHRF recommendation was amended by the ODHCC to include this new evidence and evidence from research questions 5, 6, 13, 14, 16 and 18.

Recommendation:

12. Employers should provide ongoing education, training, information, resources and products that will reduce the incidence and prevalence of occupational contact dermatitis in health care workers. A multifaceted hand hygiene program is recommended to effect behaviour change. The program should include: targeted and sustained education and training on hand hygiene best practices; a hand care program with education on skin self-screening and reporting; direction for appropriate selection and use of gloves and of emollient hand creams and lotions; and provision of ready access to emollient hand creams and lotions, hand hygiene products and appropriate gloves. (Rating IIA; research questions 4, 5, 6, 14, 16, and 18)

Research Question 5: Do education and training programs increase the likelihood of secondary prevention of occupational contact dermatitis?

This research question was not associated with any of the three selected guideline documents and was added by the ODHCC.[49,50,89,123,124]

Dulon et al. studied 386 geriatric nurses who were exposed to an educational skin care program that provided training on skin structure, occupational risk factors for hand eczema, symptoms and risk factors for occupational contact dermatitis, and practical instructions for skin care.[131] The implementation also included an occupational advisory service that was developed by the Professional Association for Health Services and Welfare in Germany. The advisory service targeted senior management to encourage protective measures at the organizational level, including development of a facility-related skin policy with written guidelines for recommended hand hygiene and skin care products. At three-month follow-up, skin disease was significantly reduced from 26% to 17% in the

implementation group and did not change in the control group (who did not receive the training intervention). There was also a significant increase in the use of emollient hand creams and hand disinfection instead of hand washing. Although provision of cotton gloves was significantly increased in those workplaces receiving the intervention, their use remained low. Van der Meer et al. reported that the multifaceted implementation strategy was effective in improving compliance with recommendations for the prevention of hand eczema.[130]

A better understanding of barriers and facilitators to the implementation of evidence-based guidelines would help to improve the effectiveness of education and training programs. Van der Meer et al. interviewed 19 HCWs to identify barriers and facilitators in the implementation of recommendations for hand eczema prevention. In general, knowledge and awareness were facilitators to guideline implementations and not knowing enough about hand eczema was a barrier to implementation.[132]

Other studies have similarly reported improvements in skin protective behaviours (including a reduced time from onset of symptoms to diagnosis) and skin condition following the implementation of education and training programs.[125,127,129,133-138] Heron suggested that repeated training or refreshers are likely required to sustain improvements beyond one year;[129] however, in some studies the positive effects of education and training were measurable for up to 10 years.[125,127,129,133-138]

Holness and Nethercott evaluated current skin condition versus current knowledge of skin diagnosis and found a positive association between knowing the correct diagnosis and positive prognosis.[139]

Based on additional evidence from research questions 4, 6, 13, 14, 16 and 18, the BOHRF recommendation associated with research question 4 was amended by the ODHCC to include this evidence.

Recommendation:

12. Employers should provide ongoing education, training, information, resources and products that will reduce the incidence and prevalence of occupational contact dermatitis in health care workers. A multifaceted hand hygiene program is recommended to effect behaviour change. The program should include: targeted and sustained education and training on hand hygiene best practices; a hand care program with education on skin self-screening and reporting; direction for appropriate selection and use of gloves, emollient hand creams and lotions; and provision of ready access to emollient hand creams and lotions, hand hygiene products and appropriate gloves. (Rating IIA; research questions 4, 5, 6, 14, 16, and 18)

Research Question 6: Do education and training programs for management of occupational contact dermatitis enable affected workers to avoid occupation change, job loss or retirement?

This research question was included in the BOHRF Guidelines.[49,50]

The impact of education and training programs varies.[49,50] There is some evidence to support the use of education and training as a key component of a multifaceted program to reduce occupation change, job loss or retirement. Holness and Nethercott found that workers with occupational contact dermatitis, who stated that they did not understand their diagnosis and its causes, were three times as likely as those who correctly identified their diagnosis to have active dermatitis that was more severe and more likely to interfere with home and work activities.[139] Better outcomes were also reported following nurse-led education programs for irritant contact dermatitis.[49,50] The review of evidence reported by BOHRF indicated that improved prognosis can result from educating workers about their diagnosis and informing them on how to manage symptoms and avoid exposures.[49,50,139]

More recently, severity of hand eczema was reported as a significant predictor of leaving the trade in hairdressers.[140] Among 5,239 hairdressers who completed a self-administered questionnaire, 44.3% of them were ex-hairdressers. Of those, 23.1% reported that their hand eczema contributed to their career change. The authors concluded that outcomes could be improved by providing hairdressers, and those in other high-risk occupations, with training to raise awareness of their occupational exposures and to promote proper glove use and skin care. Ibler et al. found that HCWs who received relevant education and training had a significant improvement in hand eczema severity, as measured by the hand eczema severity index (HECSI), compared to a control group that had no training.[68] It is reasonable to assume that improving outcomes through education could play a role in reducing occupation change, job loss or retirement.

Modification of work tasks to avoid causative exposure may also be required to prevent job loss or retirement.[141] Chen et al. used a combination of return-to-work components in a group of 18 nurses with hand dermatitis. The return-to-work program included graduated shifts or hours, modified work, precautions to avoid or reduce exposures, and optimized skin care management. Education, ongoing monitoring and physician follow-up were important elements of the return-to-work strategy. The authors concluded that multiple factors were important in facilitating return to work and in keeping nurses in their original roles.[126]

There is no evidence to suggest an optimal frequency or duration of education and training programs. Older age was reported as an independent risk factor for occupation change,[142] which may be because younger people have more capacity and ability to retrain and change occupations.

Targeted education and training programs may offer some benefit for HCW to avoid occupation change, job loss or retirement. Education and training programs may be more effective when used in combination with other intervention strategies.

Based on additional evidence from research questions 4, 5, 13, 14, 16 and 18, the BOHRF recommendation associated with research question 4 was amended by the ODHCC to include this evidence.

Recommendation:

12. Employers should provide ongoing education, training, information, resources and products that will reduce the incidence and prevalence of occupational contact dermatitis in health care workers. A multifaceted hand hygiene program is recommended to effect behaviour change. The program should include: targeted and sustained education and training on hand hygiene best practices; a hand care program with education on skin self-screening and reporting; direction for appropriate selection and use of gloves and of emollient hand creams and lotions; and provision of ready access to emollient hand creams and lotions, hand hygiene products and appropriate gloves. (Rating IIA; research questions 4, 5, 6, 14, 16, and 18)

2.3.2 Skin Screening and Surveillance

An ideal screening test should take only a few minutes to perform and be inexpensive. It also needs to be acceptable to the person completing it, requires minimal preparation and results in minimal or no discomfort.[143,144]

The effectiveness of different screening tools can be evaluated based on the sensitivity, specificity and predictive value of each test:

- Sensitivity measures how effective a screening test is in correctly identifying occupational contact dermatitis in HCWs who have occupational contact dermatitis.
- Specificity measures how effective a screening test is in correctly excluding HCWs who do not have occupational contact dermatitis.
- Positive predictive value is the probability that HCWs with a positive screening test for occupational contact dermatitis truly have occupational contact dermatitis.
- Negative predictive value is the probability that HCWs with a negative screening test for occupational contact dermatitis truly do not have occupational contact dermatitis.

(See 1.11 Elements of a Hand Care Program for more information on skin screening and surveillance.)

Research Question 7: Does skin screening prevent occupational contact dermatitis?

This research question was included in the BOHRF Guidelines.[49,50]

Screening in HCWs, using questionnaires and/or medical examination, aims to identify HCWs at risk for occupational contact dermatitis and to detect occupational contact dermatitis at a point when intervention would be beneficial. Positive screening results may indicate the presence of occupational contact dermatitis or the strong likelihood of occupational contact dermatitis, and/or the need for confirmatory skin prick or patch testing when appropriate for allergic contact dermatitis.

The utility of screening may be impacted by a HCW's knowledge of occupational contact dermatitis. Van der Meer et al. implemented a multifaceted training and education strategy among HCWs. An understanding of occupational contact dermatitis symptoms compared to normal skin may have led to increased self-reporting of suspected disease or detection on screening.[130,132,145-148] The effectiveness of skin screening in the early detection of occupational contact dermatitis in the workplace or the comparative effectiveness of different screening methods to prevent development of occupational contact dermatitis is unknown.[49,50]

Based on a lack of an evidence base, it is not clear whether skin screening prevents occupational contact dermatitis (primary prevention). It is also unclear whether there are any indirect effects of skin screening on secondary or tertiary prevention of occupational contact dermatitis (e.g., spillover effects leading to raised awareness and improved protective behaviours).

Research Question 8: Does skin health surveillance prevent occupational contact dermatitis?

This research question was included in the BOHRF Guidelines.[49,50]

Skin health surveillance is the systematic ongoing collection, collation and analysis of nominal data (e.g., data from workers' compensation, occupational screening, occupational health clinics) with timely dissemination of non-nominal information to those who require it in order to take action. The major components of surveillance programs are: periodic identification and collection of health information, evaluation and interpretation of the information, and reporting and intervention for the purpose of prevention.[15]

The effectiveness of skin health surveillance in the early detection of occupational contact dermatitis in the workplace or the comparative effectiveness of different surveillance methods to prevent development of occupational contact dermatitis is unknown.[49,50]

Based on a lack of an evidence base, recommendations on the role of skin health surveillance in the prevention of occupational contact dermatitis are not possible at this time. Based on expert opinion, health care settings with an interest in conducting surveillance could use a targeted approach to surveillance that is focused on a specific, high-risk setting or during the introduction of a new product into a specific work area (e.g., closely monitoring for skin breakdown during the introduction of a new disinfectant/cleaning agent or new liquid hand soap). Approaches to surveillance could be adapted

from existing strategies described elsewhere for surveillance of health care–associated infections described elsewhere.[149]

Research Question 9: Does skin screening result in earlier diagnosis of occupational contact dermatitis?

This research question was included in the RCP Guidelines.[123,124] The RCP Guidelines did not identify any evidence to inform recommendations on the effectiveness of skin screening in early detection of occupational contact dermatitis.

The ODHCC presented evidence that prognosis is significantly better (i.e., hand eczema symptoms resolved) when the time from onset of occupational contact dermatitis symptoms to diagnosis was less than one year, compared to when that time was greater than one year. (For additional information, see research question 25.) This finding emphasizes the importance of early diagnosis and management. Routine screening (at least once yearly), supported by education and training, can be useful in early detection of occupational contact dermatitis. Accordingly, based on additional evidence from research questions 10, 24 and 25, the following recommendation was put forth by the ODHCC.

> **Recommendation:**
>
> 7. As timely diagnosis of contact dermatitis within one year of onset of symptoms can improve outcomes, routine screening (preplacement and periodic) using a validated and feasible tool can be used to identify individuals who may benefit from further expert evaluation and diagnosis. (Rating IIIB; research questions 9, 10, 24 and 25)

It is the opinion of the ODHCC that a validated tool for routine screening is one that has high sensitivity and at least moderate specificity. The rationale for these criteria is to be able to identify, with the highest certainty possible, all HCWs (high sensitivity) who could benefit from early treatment and thus potentially avoid the development of a chronic skin disease with long-lasting implications.

Feasibility of a tool for routine screening relates to the ability of the tool to require little training to use (especially for self-reported screening, which should be accessible to all education levels), be short and easy to conduct (not requiring special appointments), be low cost, not adversely affect the HCWs being screened, and be accepted for use (e.g., the workplace culture sees the screening as important).[143,144]

There is a significant economic burden associated with occupational contact dermatitis arising from medical care costs, loss of productivity and time off work.[46] Future research that compares the cost of conducting screening with the cost savings associated with earlier diagnosis would help to inform recommendations on optimal screening frequency.

Research Question 10: Is skin screening to identify workers with suspected occupational contact dermatitis for further evaluation by a dermatologist using a self-administered questionnaire (symptoms- and/or picture-based) effective to replace screening by skin inspection by a trained occupational health expert?

This research question was included in the RCP Guidelines.[123,124] The RCP Guidelines did not identify any evidence to inform recommendations on the effectiveness of skin screening in the early detection of occupational contact dermatitis, or on the comparative effectiveness of different screening methods.

Using different definitions of hand dermatitis and different screening tools to diagnose hand dermatitis can result in different estimates of prevalence. Smit et al. compared a medical diagnosis of hand dermatitis to diagnoses made using both a symptom-based questionnaire and a self-reported questionnaire.[150] Among 109 nurses, 20 (18.3%) had a medical diagnosis of dermatitis, 52 (27.7%) had a symptom-based questionnaire diagnosis and 19 (19.4%) had a self-reported questionnaire diagnosis. The sensitivity of the self-reported questionnaire was lower than of the symptom-based questionnaire, but the specificity and the positive predictive value were higher. The authors concluded that symptom-based questionnaire can be used to screen for hand dermatitis, but that confirmatory evaluation should be completed by dermatological examination. In other studies,[151,152] variations of the Nordic Occupational Skin Questionnaire (NOSQ) have been used with moderate sensitivity and specificity to detect hand eczema. In all these studies,[150-152] the authors suggested that the questionnaires were effective at removing those not requiring examination because they did not have hand dermatitis (high negative predictive value), and that further confirmatory evaluation should be completed by a dermatologist.

Van Wendel de Joode et al. evaluated two self-administered questionnaires in a group of 80 workers exposed to metal-working fluids.[153] Both a symptom-based questionnaire and a picture-based, skin-screening list were used to detect contact dermatitis. Forty-seven of the workers were also examined by a dermatologist. The symptom-based questionnaire had a relatively high sensitivity and moderate specificity; the skin-screening list had a low sensitivity and a relatively high specificity. The authors concluded that because of its higher specificity (i.e., fewer false positives) the skin-screening list would be useful in epidemiological surveys where there is no follow-up with a dermatologist, and the symptom-based questionnaire would be useful in practice to identify workers with dermatitis symptoms who should be seen by a dermatologist for confirmatory testing (i.e., to identify false positives).

Nichol and colleagues piloted a short screening tool in an acute care setting for HCWs who presented to an occupational health clinic or were recruited from patient care areas.[154] The tool was either self-administered (N=283) or completed with an occupational health nurse (N=225) and the results were compared to screening performed by a dermatologist. The screening tool had five sections: demographics and workplace characteristics; current exposures to wet work, frequency of hand washing, and protective glove use practices; history of skin conditions; screening results (normal, mild or moderate/severe); and feasibility evaluation. A photo guide (not standardized and only of Caucasian hands) was provided as a supplement to assist categorizing the hand eczema. Agreement between the tool and dermatological assessment was fair whether the tool was self-administered or performed by an occupational health nurse; the main disagreement was between the “normal” and “mild” skin screening

results. Nevertheless, 99% of users rated the tool as easy to use, and over 90% said it took less than two minutes to complete. The screening tool offers promise, but further refinements are required.

The ODHCC concluded that self-administered screening tools to identify suspected occupational contact dermatitis for further evaluation by a dermatologist may be feasible to use. These tools may be more efficient than skin inspection by a trained occupational health expert. However, it remains necessary for identified HCWs to be further assessed by a dermatologist for a formal diagnosis. Unfortunately, an evaluation of feasibility has not been specifically detailed by any study.

Based on additional evidence, the following recommendation was put forth by the ODHCC.

> **Recommendation:**
>
> 7. As timely diagnosis of contact dermatitis within one year of onset of symptoms can improve outcomes, routine screening (preplacement and periodic) using a validated and feasible tool can be used to identify individuals who may benefit from further expert evaluation and diagnosis. (Rating IIIB; research questions 9, 10, 24 and 25)

A quantitative Hand Eczema Score for Occupational Screenings (HEROS) tool was reported by Weistenhofer et al. to be effective in quantifying minimal skin impairment in early hand eczema.[155] This type of tool could be useful for specialists conducting expert evaluation and diagnosis, but would not serve as a tool for screening as it would not be feasible. Additional examples of tools used for further expert evaluation and diagnosis are the Hand Eczema Severity Index (HECSI), the Physician's/Investigator's Global Assessment (PGA or IGA), and the Osnabrueck Hand Eczema Severity Index (OHSI).[156,157]

See Appendix F for a list and short description of the screening tools and severity assessment identified in the current literature review.

2.3.3 Hand Hygiene Best Practices

Hand hygiene is a general term referring to any action of hand cleaning. Hand hygiene in health care settings relates to the removal or killing of transient microorganisms from the hands and the removal of visible soil. Hand hygiene is essential for infection prevention and control and is required practice for all HCWs.

More information on hand hygiene best practices can be found in the Provincial Infectious Diseases Advisory Committee *Best Practices for Hand Hygiene in All Health Care Settings*.[82]

Research Question 11: Does the application of emollients help prevent the development of occupational contact dermatitis?

This research question was included in the BOHRF Guidelines.[49,50]

Hand hygiene best practices include providing staff with appropriate, allergen-free (e.g., free of fragrances and preservatives) hand moisturizing–skin care products and encouraging their regular, frequent use to minimize the occurrence of irritant contact dermatitis associated with hand hygiene.[82] Based on a systematic review, the BOHRF Guidelines presented evidence that the regular application of emollients (referring to emollient hand lotions) helps to prevent the development of occupational contact dermatitis,[49,50] but did not identify evidence to address the optimal timing and frequency of application. HCWs should only use emollient dispensers with clean hands to avoid contamination of the dispensers.

The current literature search did not identify updated evidence; the recommendation put forth in the BOHRF Guidelines was accepted by the ODHCC with minor modifications.

> **Recommendation:**
>
> 13. Employers should provide emollient hand lotions in the workplace and educate health care workers to use them regularly. (Rating IA; research question 11)

Research Question 12: Do prework (barrier) creams help prevent the development of occupational contact dermatitis?

This research question was included in the BOHRF Guidelines.[49,50]

Evidence for the effectiveness of barrier creams in preventing irritant and allergic contact dermatitis is mixed.[49,50] In certain occupational settings, barrier creams may actually increase the risk of irritant contact dermatitis by trapping irritants under the cream or by increasing penetration of irritants in the skin.[82,158] Not applying barrier cream properly may exacerbate irritation. There is weak evidence to suggest that barrier creams may promote uptake of allergens from latex gloves. In addition, HCWs with latex allergies would not be protected from those allergens by applying a barrier cream.[49,50]

Based on a systematic review, the BOHRF Guidelines reported that some barrier creams may help to prevent the development of occupational contact dermatitis, but that barrier creams are not generally effective as a preventative measure.[49,50] Workers who use barrier creams may perceive a level of protection that prevents them from using other more effective hand care measures.

The current literature search did not identify updated evidence; the recommendation put forth in the BOHRF Guidelines was accepted by the ODHCC with slight modifications.

Recommendation:

16. Employers should not promote the use of prework (barrier) creams by health care workers in health care settings. (Rating IIB; research questions 12, 16 and 18)

Research Question 13: How can skin integrity be maintained when performing hand hygiene in order to minimize the development of occupational contact dermatitis?

This research question was included in the HPS SICP Literature Review which was used to inform the Scottish National Infection Prevention and Control Manual (NIPCM).[89]

Frequently performing hand hygiene may lead to the development of occupational contact dermatitis because surfactants in hand hygiene products can damage the skin's barrier. Compared to soap and water, alcohol-based hand rub (ABHR) is less damaging for performing hand hygiene. ABHR containing emollients is the preferred method for hand hygiene when hands are not visibly soiled. Hand washing with soap and running water must be performed when hands are visibly soiled.[82] ABHR should contain 70% to 90% of either ethanol or isopropanol in order to be effective against microorganisms, including norovirus.[83] Concentrations above 90% are less able to denature proteins, a requirement for killing microorganisms.[84] HCWs have generally rated the use of ABHR as highly acceptable and tolerable, but may find products containing alcohol cause stinging. This usually happens when skin is already irritated. More information on hand hygiene best practices can be found in the Provincial Infectious Diseases Advisory Committee *Best Practices for Hand Hygiene in All Health Care Settings*.[82]

While alcohols in ABHR have powerful antibacterial activity against many gram-positive bacteria (e.g., methicillin-resistant *Staphylococcus aureus* [MRSA]), gram-negative bacteria and certain fungi that surpass the log reduction capability of soap and water, they have less activity against spore-forming bacteria, such as *Clostridioides difficile* (*C. difficile*) and *Bacillus* spp.[159,160] When a dedicated hand-washing sink is immediately available, hands should be washed with soap and water. When a dedicated hand-washing sink is not immediately available, hands should be cleaned using ABHR.[82] These directions are based on a special risk assessment when spore-forming organisms are suspected. In this instance, hand washing with soap and water is preferred to using ABHR because the implications of infection transmission (patient safety) outweigh any deleterious effects of exposure of HCW hands to soap and water (occupational health and safety). In most other circumstances, ABHR is preferred for its greater efficacy of log reduction of microorganisms (patient safety) and is the least harmful form of hand hygiene (occupational health and safety).

To further reduce the harm that repeated hand washing can have on HCWs, employers should select and provide paper towel that is absorbent and not abrasive, and HCWs should be instructed on proper technique for drying hands (i.e., dabbing, not rubbing). No evidence was reviewed that compared paper towel products and their impact on incidence or prevalence of occupational contact dermatitis. One

article was identified that discussed audit and introduction of new paper towel products wherein HCWs preferred higher-quality paper towels that were more expensive.[161]

The recommendation put forth in the HPS SICP Literature Review was accepted by the ODHCC with slight modifications.

> **Recommendation:**
>
> 20. Workers should use alcohol-based hand rub containing emollients as the preferred method of hand hygiene when hands are not visibly soiled. (Rating IIB; research question 13)

The HPS SICP Literature Review presented evidence that hands should not be washed immediately after using ABHR.[89] Washing may remove the benefits of the emollients found in ABHR and potentially deteriorate skin conditions. The recommendation put forth in the HPS SICP Literature Review was accepted by the ODHCC with slight modifications.

> **Recommendation:**
>
> 21. Hands should not be washed immediately after using alcohol-based hand rub. (Rating IIIA; research question 13)

The HPS SICP Literature Review found evidence to support the role of emollient hand creams in maintaining skin integrity that can be breached by hand washing.[89] All the identified studies recommended using emollient hand creams throughout the work day (e.g., at breaks and after cleaning hands with soap and water) and outside of work (before and after work) to prevent irritant contact dermatitis resulting from frequent hand hygiene; and recommended applying them all over the hands, including between the fingers and the backs of the hands.[89] In addition, HCWs should only use emollient dispensers with clean hands to avoid contamination of the dispensers. The recommendation put forth in the HPS SICP Literature Review was accepted by the ODHCC with slight modifications.

> **Recommendation:**
>
> 17. Emollient hand creams or lotions, that are free of allergens, should be used regularly. Hand creams or lotions should be applied all over the hands, including between the fingers and the back of the hand. (Rating IIA; research question 13)

Hand creams selected for use should not affect the efficacy of hand hygiene products or the integrity of

gloves. For example, oil-based products can reduce the integrity of latex gloves.[89] The recommendation put forth in the HPS SICP Literature Review was accepted by the ODHCC with slight modifications.

> **Recommendation:**
>
> 18. Emollient hand creams and lotions used in the health care setting must not compromise the efficacy of the hand hygiene products or gloves used. (Rating IIIA; research question 13)

The HPS SICP Literature Review presented evidence that communal tubs of hand cream should not be used as these have the potential to become easily contaminated.[89] The recommendation put forth in the HPS SICP Literature Review was accepted by the ODHCC with slight modifications.

> **Recommendation:**
>
> 15. Communal tubs and tubes of hand cream or lotion should not be used. (Rating IIA; research question 13)

Hand washing and hand care products should use sealed refills instead of open, refillable dispensers to lower the risk of contamination and reduce the spread of microorganisms. Zapka et al. found that bacteria on the hands increased after washing with soap from contaminated bulk-soap refillable dispensers.[162] In contrast, washing with soap from dispensers with sealed refills significantly reduced bacteria on hands.

For health care settings, emollients should be provided in the form of lotions. Emollient hand creams may be used in health care settings provided that the HCW receives approval and instructions on their use from a health care practitioner. The instructions should include considerations for infection control, since the containers or tubes these formulations are typically provided in are prone to contamination and may be a source of transmission if shared. To avoid contamination of the dispensers, HCWs should only use emollient dispensers if their hands are clean. The ODHCC added the following recommendation related to emollient hand lotion dispensers.

> **Recommendation:**
>
> 14. To prevent contamination, emollient hand lotions should be provided by the facility in dispensers or pumps that are not topped up or refilled. (Rating IIA; research question 13)

Research Question 14: Does adhering to hand hygiene best practices, including a hand care program and appropriate selection and use of gloves, improve primary prevention of dermatitis in the workplace?

Research Question 15: What is the comparative effectiveness of different hand hygiene best practices, including a hand care program and appropriate selection and use of gloves, on the primary prevention of occupational contact dermatitis?

These research questions are based on a recommendation in the RCP Guidelines for future guideline development.[123,124]

There is no recommendation associated with research question 15 because there is not enough evidence to determine the comparative effectiveness of different hand hygiene best practices in primary prevention. The recommendation for research question 14 includes evidence from research questions 4, 5, 6, 13, 16 and 18. The BOHRF recommendation associated with research question 4 was amended by the ODHCC to include this evidence.

> **Recommendation:**
>
> 12. Employers should provide ongoing education, training, information, resources and products that will reduce the incidence and prevalence of occupational contact dermatitis in health care workers. A multifaceted hand hygiene program is recommended to effect behaviour change. The program should include: targeted and sustained education and training on hand hygiene best practices; a hand care program with education on skin self-screening and reporting; direction for appropriate selection and use of gloves and of emollient hand creams and lotions; and provision of ready access to emollient hand creams and lotions, hand hygiene products and appropriate gloves. (Rating IIA; research questions 4, 5, 6, 14, 16 and 18)

Research Question 16: Does adhering to hand hygiene best practices, including a hand care program and appropriate selection and use of gloves, improve secondary prevention of dermatitis in the workplace?

Research Question 17: What is the comparative effectiveness of different hand hygiene best practices, including a hand care program and appropriate selection and use of gloves, on the secondary prevention of occupational contact dermatitis?

These research questions were included in the RCP Guidelines.[123,124]

The BOHRF Guidelines presented evidence that barrier creams do not improve skin condition in workers with damaged skin.[49,50] No recommendations were put forward in the BOHRF Guidelines. The RCP Guidelines presented evidence that barrier creams used in workplace settings by workers with damaged

skin were no better than cream formulations without barrier ingredients in improving clinical indicators of skin condition.[123,124]

The following recommendation was put forth by the ODHCC. (See research question 12 for more information on the use of barrier creams.)

> **Recommendation:**
>
> 16. Employers should not promote the use of prework (barrier) creams by health care workers in health care settings. (Rating IIB; research questions 12, 16 and 18)

The BOHRF Guidelines presented evidence that emollient hand lotions improve skin condition in workers with damaged skin,[49,50] with one study showing a benefit of up to 23% following prophylactic use of emollients.[49,50] The RCP Guidelines presented evidence that emollients improve skin condition in HCWs with damaged skin.[123,124] (See 1.11 Elements of a Hand Care Program.)

The current literature search identified updated evidence that was consistent with the recommendation put forth in the RCP Guidelines; the RCP recommendation was accepted by the ODHCC with minor modifications.

> **Recommendation:**
>
> 19. Workers with existing dermatitis should be advised to use emollient hand creams or lotions, that are free of allergens, at work. (Rating IIIA; research questions 16 and 18)

According to the RCP Guidelines, the effectiveness of barrier creams is controversial.[123,124] It is difficult to determine their effectiveness because there is variability in how they are used, uncertainty about penetration rates, and difficulty determining the duration of any effectiveness.

Evidence was also presented that ABHR is less damaging than traditional antiseptic hand wash agents or soap to the skin of users with no symptoms or mild to moderate symptoms of hand eczema.[123,124] Recommendations for ABHR use are different for HCWs who require tertiary prevention measures (i.e., those with moderate to severe hand eczema) (See 1.13 Hand Hygiene Best Practices and Glove Use Based on Severity of Occupational Contact Dermatitis and research questions 13, 18.)

Recommendation:

22. Health care workers with dermatitis should use alcohol-based hand rub containing emollients, if tolerated, when hands are not visibly soiled. Those who experience discomfort from hand hygiene should be individually assessed, preferably by an occupational health professional. (Rating IIB; research questions 16 and 18)

The RCP Guidelines reported inconsistent evidence on the effectiveness of comprehensive skin care programs in workers with existing dermatitis. The interpretation of their evidence was complicated by the fact that the study groups had subjects both with and without dermatitis at baseline. Significant improvements in outcomes were reported in one study but not in another.[123,124]

There is no recommendation associated with research question 17 because there is not enough evidence to determine which components of multifaceted programs have the most effect. The recommendations for research question 16 include additional evidence from research questions 4, 5, 6, 13, 14 and 18. The BOHRF recommendation associated with research question 4 was amended by the ODHCC to include this evidence.

Recommendation:

12. Employers should provide ongoing education, training, information, resources and products that will reduce the incidence and prevalence of occupational contact dermatitis in health care workers. A multifaceted hand hygiene program is recommended to effect behaviour change. The program should include: targeted and sustained education and training on hand hygiene best practices; a hand care program with education on skin self-screening and reporting; direction for appropriate selection and use of gloves and of emollient hand creams and lotions; and provision of ready access to emollient hand creams and lotions, hand hygiene products and appropriate gloves. (Rating IIA; research questions 4, 5, 6, 14, 16 and 18)

Research Question 18: Does adhering to hand hygiene best practices, including a hand care program and appropriate selection and use of gloves, improve tertiary prevention of dermatitis in the workplace?

Research Question 19: What is the comparative effectiveness of different hand hygiene best practices, including a hand care program and appropriate selection and use of gloves, on the tertiary prevention of occupational contact dermatitis?

These research questions were included in the BOHRF Guidelines[49,50] and the RCP Guidelines.[123,124]

The BOHRF Guidelines presented evidence that barrier creams do not improve skin condition in workers with damaged skin.[49,50] No recommendations were put forward in the BOHRF Guidelines. The RCP Guidelines presented evidence that barrier creams used in workplace settings by workers with damaged skin were no better than cream formulations without barrier ingredients in improving clinical indicators of skin condition.[123,124]

The following recommendation was put forth by the ODHCC. (See research question 12 for more information on the use of barrier creams.)

> **Recommendation:**
>
> 16. Employers should not promote the use of prework (barrier) creams by health care workers in health care settings. (Rating IIB; research questions 12, 16 and 18)

The BOHRF Guidelines presented evidence that emollient hand lotions improve skin condition in workers with damaged skin,[49,50] with one study showing a benefit of up to 23% following prophylactic use of emollients.[49,50] The RCP Guidelines presented evidence that emollients improve skin condition in HCWs with damaged skin.[123,124] (See 1.13 Hand Hygiene Best Practices and Glove Use Based on Severity of Occupational Contact Dermatitis and research questions 13 and 16.)

The current literature search identified updated evidence that was consistent with the recommendations put forth in the RCP Guidelines; the RCP recommendation was accepted by the ODHCC with minor modifications.

> **Recommendation:**
>
> 19. Workers with existing dermatitis should be advised to use emollient hand creams or lotions, that are free of allergens, at work. (Rating IIIA; research questions 16 and 18)

Programs that promote education and training for hand hygiene best practices, including a hand care program and appropriate selection and use of gloves, lead to improvements in quality of life indicators such as job retention (e.g., avoidance of occupation change, job loss, retirement), mental health symptoms, personal life function and sick leave. Moreover, improvements in skin condition are associated with these quality of life improvements. (For additional information, see research question 27.)

There is no recommendation associated with research question 19 because there is not enough evidence to determine which components of multifaceted programs have the most effect.
The recommendations for research question 19 includes additional evidence from research questions 4,

5, 6, 13, 14 and 16. The BOHRF recommendation associated with research question 4 was amended by the ODHCC to include this evidence.

Recommendations:

12. Employers should provide ongoing education, training, information, resources and products that will reduce the incidence and prevalence of occupational contact dermatitis in health care workers. A multifaceted hand hygiene program is recommended to effect behaviour change. The program should include: targeted and sustained education and training on hand hygiene best practices; a hand care program with education on skin self-screening and reporting; direction for appropriate selection and use of gloves and of emollient hand creams and lotions; and provision of ready access to emollient hand creams and lotions, hand hygiene products and appropriate gloves. (Rating IIA; research questions 4, 5, 6, 14, 16 and 18)

22. Health care workers with dermatitis should use alcohol-based hand rub containing emollients, if tolerated, when hands are not visibly soiled. Those who experience discomfort from hand hygiene should be individually assessed, preferably by an occupational health professional. (Rating IIB; research questions 16 and 18)

Due to the severity of symptoms experienced by those requiring tertiary interventions, hand hygiene best practices may not be sufficient. In these more severe cases, specialized, intensive, individual prevention plans may be required. In particular, workplace modifications to reduce exposure, redeployment, consistent use of cotton glove liners, and medical treatment are likely to be necessary. There is not enough evidence about improving tertiary prevention of dermatitis in the workplace using components of hand hygiene best practices, hand care programs, and appropriate selection and use of gloves to determine which components are the most important to improve tertiary prevention of dermatitis in the workplace. Based on this updated evidence and expert opinion the following recommendation was put forth by the ODHCC.

Recommendation:

6. Specialized, intensive individual prevention programs, including workplace modification, should be developed for health care workers with moderate to severe occupational contact dermatitis. These programs should use approaches that target improvements in both physical and mental health. (Rating IIIB; research questions 18, 20 and 27)

2.3.4 Redeployment and Workplace Modifications

Research Question 20: What evidence is there for benefit of workplace modification for tertiary prevention of occupational contact dermatitis?

This research question was included in the BOHRF Guidelines.[49,50] Their search found relatively few studies addressing secondary or tertiary prevention.

A large study and a case series did not demonstrate any clinical improvement following workplace modifications (e.g., providing advice about work practices and personal protective equipment).

Clinical improvement was documented in five studies where workplace modification included exposure control or personal protective equipment.[49,50]

As discussed in research question 23, gloves can be deleterious to hands if used inappropriately. Cotton glove liners may offer some protection against potential harmful effects of gloves.[49,50]

The ODHCC did not identify any studies where cotton glove liners were used as the sole means to improve hand condition, but did identify studies where they were recommended as part of an overall, individual prevention program.

Mälkönen et al. studied the impact on prognosis of changed work tasks (e.g., changes in working methods/tasks, exposures and/or use of protective gloves) and changed job or occupation, both at 6 months and at 7 to 14 years after diagnosis of occupational skin disease.[141,163] The authors reported healing of hand eczema at 6 months after diagnosis in 27% of workers who changed work tasks, but in only 17% of workers who had no change in their work. When job or occupation was changed or lost, 34% to 43% of workers experienced healing.

The benefit of workplace modifications in a small group of nurses as part of a multidisciplinary, multifaceted return-to-work program was investigated by Chen et al.[126] The program allowed most nurses to return to patient care duties with modifications. Prior to the program, 6 nurses (33%) were providing patient care with modification, 12 (67%) were in nonpatient care positions and none were off work. After the program, 14 (78%) returned to direct patient care with modifications, 3 (17%) were in nonpatient care positions, and 1 (6%) was no longer working due to skin disease.

The current literature search identified updated evidence that was consistent with the recommendation put forth in the BOHRF Guidelines; the BOHRF recommendation was accepted by the ODHCC with minor modifications that also considered evidence from research questions 3, 18, 26 and 27.

Recommendations:

2. If the diagnosis is uncertain or the dermatitis is persistent despite clinical assessment and treatment by the health care practitioner, then the health care worker should be assessed by a physician with expertise in occupational contact dermatitis for recommendations regarding appropriate medical treatment and workplace modifications. (Rating IIIB; research questions 3, 20 and 26)

6. Specialized, intensive individual prevention programs, including workplace modification, should be developed for health care workers with moderate to severe occupational contact dermatitis. These programs should use approaches that target improvements in both physical and mental health. (Rating IIIB; research questions 18, 20 and 27)

Research Question 21: What evidence is there for benefit of redeployment for tertiary prevention of occupational contact dermatitis?

This research question was included in the BOHRF Guidelines.[49,50]

Redeployment is the temporary or permanent reassignment of employees to other departments or jobs within the organization, as an alternative to layoff, when a job can no longer be accommodated for the health and safety of the individual.

The BOHRF Guidelines only identified a few studies on outcomes of redeployment as a strategy to improve symptoms of existing dermatitis. In some studies, no clinical improvement was noted, and in other studies, redeployment combined with exposure control resulted in improvement of symptoms.[49,50]

Redeployment was assessed related to consequences of occupational skin disease by Mälkönen et al.[141,163] No change in work tasks (e.g., changes in working methods/tasks, exposures and/or use of protective gloves) was a strong prognostic factor for continuing hand eczema. Participants who were redeployed (job change) or had changed occupation were noted to have improved healing of hand eczema six months after diagnosis. Workers who changed jobs were twice as likely as those with no work changes to report healing of their skin disease.

A multidisciplinary, multifaceted return-to-work program resulted in improvement of the condition of most HCWs' hands such that they could return to work with modifications. Only 3 of the remaining 18 HCWs were redeployed and 1 HCW progressed to loss of job.[126]

The current literature search identified updated evidence that was consistent with the recommendation put forth in the BOHRF Guidelines; the BOHRF recommendation was accepted by the ODHCC with modification.

Recommendation:

5. If workplace modifications are unsuccessful, redeployment should be considered as the next step before occupation change, job loss or retirement. (Rating IIIB; research question 21)

2.4 Personal Protective Equipment

Personal protective equipment, the last measure to be considered in the hierarchy of exposure controls, can offer protection when selected correctly, worn properly, removed safely and either replaced or maintained regularly. Gloves are indispensable for HCWs and do not replace the need for hand hygiene. (See 1.12 Glove Use, as well as Appendix A, Appendix C, Appendix D and Appendix E for more information on the appropriate selection and use of gloves and cotton glove liners.)

Research Question 22: Is the incidence of occupational contact dermatitis reduced by personal protective equipment (i.e., gloves [including cotton glove liners])?

This research question was included in the BOHRF Guidelines.[49,50] Based on the systematic review supporting the BOHRF Guidelines, glove use should be limited to when required as a means of exposure control after other preventative measures, such as reducing exposure, education and training, and delivery of a hand care program have been considered.[49,50]

The current literature search did not identify updated evidence; the recommendation put forth in the BOHRF guideline was accepted by the ODHCC with minor modification.

Recommendation:

8. Employers should provide appropriate gloves where the risk of developing occupational contact dermatitis cannot be eliminated by removing exposure. (Rating IIA; research question 22)

Long-term use of occlusive gloves has been reported to have a negative effect on skin barrier function, especially when the occlusion is extensive and is combined with exposure to skin irritants such as soap and detergents.[104] The occlusion results in moisture being trapped against the skin, resulting in softer skin that is more sensitive to irritants. Chemical additives in gloves, including rubber accelerators such as benzothiazoles and thiurams, may also contribute to skin irritation;[164] and natural rubber latex gloves have been reported to cause occupational contact dermatitis and urticaria.[49,50]

Ramsing and Agner measured the impact of long-term glove use on intact skin. Subjects wore hypoallergenic, nonlatex gloves, either with or without cotton glove liners, 6 hours per day for 14 days.[165] The glove use had a significant negative effect on the barrier function of the skin, as measured by a decrease in transepidermal water loss. The authors concluded that glove use could play an important role in the development of irritant contact dermatitis and recommended that gloves should be worn for as short a time as possible. The decrease in transepidermal water loss was prevented with the use of cotton glove liners. (For more information on use and selection of cotton glove liners see Appendix E.)

Based on this additional evidence, the following recommendation was put forth by the ODHCC.

> **Recommendation:**
>
> 10. When occlusive glove use cannot be reduced or eliminated, using cotton glove liners may decrease the incidence of occupational contact dermatitis. (Rating IIIB; research question 22)

Research Question 23: What evidence is there for benefit of use of personal protective equipment (i.e., gloves [including cotton glove liners]) for tertiary prevention of occupational contact dermatitis?[49]

This research question was included in the BOHRF Guidelines as part of an assessment of the benefits of redeployment, workplace modifications and use of personal protective equipment.[49,50] In studies of metal workers and pharmaceutical industry workers, symptoms were controlled and workers were able to return to work when gloves are used as a form of exposure control.[49,50] Information on severity of symptoms was not provided. Since the negative effects of gloves may be enhanced in workers with moderate to severe dermatitis, caution should be exercised in recommending glove use as part of tertiary prevention. The BOHRF Guidelines provided evidence for the protective effect of glove liners against the development of occupational contact dermatitis in instances where glove use could not be avoided; however, there was no evidence for the effectiveness of cotton glove liners in tertiary prevention.[49,50]

There is recent evidence that use of protective gloves leads to avoidance of exposures to irritants or allergens, and thus can lead to improvement of skin condition. This improvement in symptoms and management was noted in studies that included use of protective gloves and/or cotton glove liners along with other skin improvement strategies.[68,125-128]

While glove use was promoted in one randomized controlled trial, the independent effect of glove use on reducing the prevalence and severity of skin disease was not reported.[68,128] In another study, a return-to-work intervention that included job modifications, protective glove use and use of cotton glove liners, was successful in reintroducing nurses to patient care work;[126] however, as the intervention was multimodal, no associations between the individual protective measures could be determined.

Other recent studies have provided mixed evidence as to the effectiveness of gloves in protecting against exposure.[125,127] This mixed evidence could be explained by differences in symptoms at the time data were collected. For example, it might appear that workers were less inclined to using protective behaviours, such as glove or cotton glove liner use, if data were collected during periods where their symptoms had improved.

Limited evidence makes it difficult to confirm whether the use of gloves worsens or improves symptoms. On one hand, skin conditions may develop or worsen if the selected gloves are not suitable to protect against an exposure (e.g., reactivity of latex gloves and oil-based products), if the skin condition was the result of allergic reaction to materials in the gloves, or the skin became irritated from prolonged use of gloves. On the other hand, if gloves are selected and used appropriately to avoid these situations, then it is plausible that glove use help to prevent or improve symptoms.

Future research on the benefits of using gloves and cotton glove liners would benefit from measuring the use of gloves during appropriate indications for their use and from studying HCWs both with and without symptoms. It would also be helpful to ascertain whether wearing cotton glove liners has a negative impact on the manual dexterity that would be required for HCWs to perform specific job tasks. HCWs might be less inclined to use cotton glove liners if they detract from required manual dexterity. (For more information on use and selection of cotton glove liners, see Appendix E.)

The following additional recommendation was put forth by the ODHCC.

> **Recommendation:**
>
> 11. When glove use is indicated, health care workers with hand dermatitis should be provided with cotton glove liners and instructed on their use. (Rating IIIB; research question 23)

2.5 Clinical Diagnosis

Research Question 24: How effective are the criteria for the diagnosis of occupational contact dermatitis to differentiate from nonoccupational contact dermatitis or other skin diseases?

This research question was included in the BOHRF Guidelines.[49,50]

Proper clinical diagnosis is made by taking a comprehensive occupational and personal history, by clinical examination and, where appropriate, by skin prick or patch testing.[49]

2.5.1 Occupational and Personal History

A comprehensive occupational and personal history is required to properly diagnose occupational contact dermatitis. A temporal relationship between the onset of signs and symptoms and workplace exposure can indicate that the exposure has either contributed to or caused a work-related contact dermatitis.[153] Pre-existing dermatitis can be aggravated by exposures at work which makes it difficult to ascertain whether the presenting symptoms are solely due to workplace exposures.[153] Taking relevant nonoccupational history may assist in determining work relatedness. A further complicating factor is that dermatitis can develop into a chronic state where work relatedness becomes less obvious and clinical diagnosis becomes more difficult. Symptoms that improve away from work might suggest an occupational cause of the skin condition; however, that is not always the case. The Mathias criteria is intended to be used when workplace association of occupational contact dermatitis is not clear.[166,167] The criteria is often used in practice despite the fact that the practical, widespread use has not been assessed.

The current literature search identified updated evidence that was consistent with the recommendation put forth in the BOHRF Guidelines; the BOHRF recommendation was accepted by the ODHCC with minor modifications that also considered evidence from research question 26.

Recommendations:

1. Health care practitioners should take a full occupational history and relevant nonoccupational history when a health care worker presents with a skin rash, asking the health care worker about their job, the materials with which they work, the location of the rash and any temporal relationship with work. A clinical assessment should be made by the health care practitioner to inform medical treatment and workplace modifications. (Rating IIA; research questions 24 and 26)

3. A diagnosis of occupational contact dermatitis should be confirmed by a physician (e.g., dermatologist) with the knowledge, skills and training to diagnose this condition with reasonable accuracy (including objective testing where indicated), and not be made solely on the basis of a compatible history. (Rating IIA; research question 24)

2.5.2 Patch Testing

Patch testing results can be inconclusive or misleading. In addition, interpretation of test results can be subjective even in those with expertise in reading patch tests. A positive test denotes sensitization which can occur with or without disease. At times, there can be multiple positive reactions. This phenomenon, referred to as “angry back” or excited skin reaction, is most likely to occur in those with very active

dermatitis and can lead to false positive results.[168] Alternatively, a false negative result may occur where there is little or no visible reaction to a substance that regularly causes dermatitis in a given worker.[42]

Standardized patch testing may be more comprehensive for some occupations and miss relevant allergens for other occupations.[169-171] In addition to a standardized series, customized testing with haptens appropriate for individual occupational exposures can provide further diagnostic information.[171] Custom patch testing must be conducted by a dermatologist or allergist with specific training in order to avoid potential sensitization.

A diagnosis of combined allergic contact dermatitis and irritant contact dermatitis may be more commonly diagnosed in occupations with wet work; however, the diagnosis is complicated because there is no definitive test for irritant contact dermatitis.[71] Underdiagnosis may occur if a relevant allergen is confirmed, but irritant exposures are not considered.[71] Schwensen suggests that underdiagnosis of combined allergic and irritant contact dermatitis may occur in predominantly male occupations.[71] Overdiagnosis may occur if a relevant allergen is confirmed, but arbitrary criteria (e.g., presence of wet work) are applied to determine relevance of irritant exposures.[71] Schwensen and colleagues offer advice for diagnosis of combined allergic and irritant contact dermatitis. For irritant contact dermatitis to be included in the diagnosis, significant exposure to known irritants is required. Wet work may be used in the diagnostic procedure when it is present in combination with a temporal relationship between allergen exposure and dermatitis, and when the dermatitis persists despite avoidance of the allergen exposure over three to six months.[71] In addition to causing irritant contact dermatitis, irritant exposure may aggravate existing dermatitis (e.g., allergic contact dermatitis).

Based on this additional evidence, the following recommendation was put forth by the ODHCC.

> **Recommendation:**
>
> 4. In order to provide additional diagnostic information, a physician with expertise in occupational contact dermatitis may conduct custom patch testing using haptens that are not commercially available in a standard tray. (Rating IIIB; research question 24)

2.5.3 Symptom-Based and Activity-Based Questionnaires

Symptom-based and activity-based questionnaires, though not as accurate as clinical evaluation, can be helpful in distinguishing those HCWs who require further expert evaluation from those who do not have occupational contact dermatitis. Adapted versions of the NOSQ collect self-reported information on demographics, occupational history, skin symptoms, exacerbating factors, life impact, skin tests, exposures, protective glove use and general health.[91,151,152]

A quantitative hand eczema score, known as the HEROS tool, has been applied in occupational settings. It was found to be adequate for quantifying early hand dermatitis where there is minimal skin

impairment.[150,155] See Appendix F for a brief description of the HEROS tool and other assessment tools identified in the current literature search.

Based on additional evidence from research questions 9, 10 and 25, the following recommendation was put forth by the ODHCC.

> **Recommendation:**
>
> 7. As timely diagnosis of contact dermatitis within one year of onset of symptoms can improve outcomes, routine screening (preplacement and periodic) using a validated and feasible tool can be used to identify individuals who may benefit from further expert evaluation and diagnosis. (Rating IIIB; research questions 9, 10, 24 and 25)

Research Question 25: Does earlier diagnosis of occupational contact dermatitis make a difference in outcomes?

This research question was not associated with any of the three chosen guideline documents and was added by the ODHCC.[49,50,89,123,124]

Chronic occupational contact dermatitis can negatively impact quality of life, resulting in significant medical, occupational, social and economic consequences for HCWs, even after exposure to causative agents has been controlled or eliminated. Understanding the role of early diagnosis of occupational contact dermatitis in outcomes can help to inform diagnostic and treatment services for HCWs with occupational contact dermatitis.

Mälkönen et al. followed 605 patients at the Finnish Institute of Occupational Health who were diagnosed with occupational hand eczema between 1994 and 2001.[163] All patients completed a follow-up questionnaire six months after their initial diagnosis and were asked to complete an additional survey in 2008, 7 to 14 years after their initial diagnosis. Based on the survey results, the authors concluded that less than one year from onset of symptoms to diagnosis of hand eczema was significantly associated with better prognosis, emphasizing the importance of early diagnosis and intervention.

Gaps in health services for workers with occupational contact dermatitis that result in diagnostic delays could also negatively impact prognosis.[172] Equitable access to diagnostic and treatment services, regardless of geographic location or other social determinants of health, would help to minimize these gaps in care.

Based on additional evidence from research questions 9, 10 and 24, the following recommendation was put forth by the ODHCC.

Recommendation:

7. As timely diagnosis of contact dermatitis within one year of onset of symptoms can improve outcomes, routine screening (preplacement and periodic) using a validated and feasible tool can be used to identify individuals who may benefit from further expert evaluation and diagnosis. (Rating IIIB; research questions 9, 10, 24 and 25)

2.6 Clinical Prognosis

Research Question 26: What is the clinical prognosis for workers with occupational contact dermatitis?

This research question was included in the BOHRF Guidelines.[49,50] A bias in the literature exists wherein publications are predominantly related to prognosis of workers identified following diagnosis and treatment in clinics or workers' compensation programs. There was less selection bias in some of the cohort studies reviewed, but their results were less generalizable since the study cohorts were derived from specific occupational settings.[49,50]

Ongoing symptoms or resolution of symptoms were equally frequent outcomes from studies identified in the BOHRF Guidelines (41% to 100% resolution, 44% to 89% ongoing symptoms). The review also identified that up to 10% of patients may not have symptom resolution following elimination of the suspected exposure.[49,50]

Risk factors for poor prognosis that were identified in the BOHRF Guidelines included: male gender, more severe occupational contact dermatitis and presence of atopic dermatitis.[49,50] The evidence for the role of atopy, worker age and other risk factors in prognosis was inconsistent. The type of allergen, particularly metal salts, can contribute to persistent occupational contact dermatitis over several years despite avoidance.

Evidence from the current literature search showed that treatment programs and counselling may improve prognosis. Apfelbacher et al. followed 253 HCWs with work-related skin diseases for one year after their participation in two-day, individual, secondary prevention courses.[125] The authors reported a 9% decrease in prevalence of symptoms (from 77% at baseline to 68% at follow-up) and concluded that those in treatment programs can have a better prognosis. In a study of hospital cleaners who participated in an evidence-based skin protection program, the mean Hand Eczema Severity Index (HECSI) score decreased from 2.8 to 1.8 at three month follow-up.[127] A HECSI score of greater than zero indicates the presence of hand eczema. Prevalence of hand eczema decreased from 58% at baseline to 38% at follow-up. In a randomized controlled trial of 247 HCWs, those who received individual counselling had improved prognosis compared to those who received treatment as usual.[68,128] Older

participants and those who had greater limitation from skin disease before beginning a treatment program were more likely to have worse outcomes at six months following the program (e.g., skin symptoms, impaired function, worse emotional status, requiring medical treatment or sick leave).[134]

Mälkönen et al. found that factors associated with poor prognosis included: no change of occupation status, male gender and respiratory atopy.[141] In the same population 7 to 14 years later, a duration of symptoms greater than 1 year was also associated with poor prognosis, whereas occupation type, allergen and gender did not affect prognosis.[163] Age was not associated with prognosis in either short- or long-term follow-up.[141,163] No difference in prognosis was noted between diagnoses of irritant or allergic contact dermatitis.[141] The authors also suggested that earlier diagnosis (within one year) could lead to better prognosis.[163]

Wall et al. reported continued occupational skin disease in some workers, even after changing jobs or occupations to avoid exposure.[173] This may be explained by factors in the new work environment that aggravated the dermatitis. Existing dermatitis should not be overlooked in workers entering a new occupation, and these workers should have clinical examination and treatment.

The proposed recommendations were informed by evidence from the current research question and from research questions 3, 20 and 24.

Recommendations:

1. Health care practitioners should take a full occupational history and relevant nonoccupational history when a health care worker presents with a skin rash, asking the health care worker about their job, the materials with which they work, the location of the rash and any temporal relationship with work. A clinical assessment should be made by the health care practitioner to inform medical treatment and workplace modifications. (Rating IIA; research questions 24 and 26)

2. If the diagnosis is uncertain or the dermatitis is persistent despite clinical assessment and treatment by the health care practitioner, then the health care worker should be assessed by a physician with expertise in occupational contact dermatitis for recommendations regarding appropriate medical treatment and workplace modifications. (Rating IIIB; research questions 3, 20 and 26)

2.7 Impact on Workers

Research Question 27: What is the impact of occupational contact dermatitis on the worker, including e.g., work life, personal life and employment?

This research question was included in the BOHRF Guidelines.[49,50] In addition to previously reported quality-of-life indicators in the BOHRF Guidelines, the ODHCC review identified new evidence that supports the BOHRF Guidelines and adds new insight into measures of mental health, chronic stress and burnout related to occupational contact dermatitis. Data were predominantly obtained from mixed-occupation studies.

The following factors were considered when reviewing the impact of occupational contact dermatitis on HCWs:

- **quality of life:** general measure of wellbeing covering work life and personal life
- **work life:** quality of daily functions/activities, relationships at work
- **personal life:** quality of daily functions/activities, relationships outside of work
- **loss of employment:** job loss as a result of dermatitis
- **economic impact:** costs borne by the health care system or the worker as a result of dermatitis
- **mitigation of impact:** interventions that reduce negative impacts on quality of life, work life, personal life, loss of employment and economic impact

Overall, workers with occupational dermatitis experience significant, negative impacts in all domains of their lives. The negative impact is evident across many occupations; however, some occupations may be more conducive to workplace modifications than others and allow for reduction of job loss and less financial impacts by maintaining employment. The severity of disease has significant correlations to all quality-of-life measures, except mental health (anxiety, burnout and chronic stress). Differences between the impact of different diagnoses (occupational allergic/irritant or combined contact dermatitis) on quality of life are rarely reported to the level of granularity that would be required to be certain of any differences. The role of age in employment-related outcomes is unclear. Females appear to have greater impairment in dimensions such as anxiety and perceptions of pain, sleeplessness and pruritus, which then impact work life, personal life and employment. No other gender differences have been observed.

2.7.1 Quality of Life

Various tools are used to measure quality of life (see Appendix G for a description of commonly-used tools identified in the current literature search). Some broadly target work and personal life, while others focus on mental health (e.g., stress, anxiety, depression, burnout, sleeplessness) or physical

health (e.g., pain, pruritus, sleeplessness). The impact on quality of life of diagnosis (allergic versus irritant contact dermatitis), severity, occupation and gender is also reported in various studies.

In a study of 1,132 nurses, those with hand eczema scored lower in all domains of the 36-Item Short Form Health Survey (SF-36), except for vitality and role limitations due to emotional problems.[174] Ibler and colleagues, using the Dermatology Life Quality Index (DLQI), found that dermatitis had a negative impact on the worker's life.[68] Matterne et al. reported that all SF-36 domains, except physical functioning, were significantly impaired in HCWs with occupational skin disease.[175]

In another study, DLQI scores indicated more impairment of work life and SF-36 scores indicated greater daily life impairment (physical component score) in patients with occupational hand eczema compared to the general population.[176]

- **Severity of Disease:** Different measurement tools have been used to determine the strength of the relationship between quality of life and disease severity. (See Appendix F and Appendix G). Overall, quality of life is negatively impacted by occupational contact dermatitis even when symptoms are mild.[49,50,68,174,175,177] In one study, 72 out of 116 patients (62%), reported a very large effect on quality of life and there was a correlation between DLQI scores and physician global assessment (PGA) severity scores.[178] Another study reported that DLQI scores were significantly correlated with Occupational Contact Dermatitis Disease Severity Index (ODDI) scores and with an analogue scale of severity completed by either patients or physicians.[179] DLQI scores also predicted severity, as measured by the Osnabrueck Hand Eczema Severity Index (OHSI) and a Visual Analogue Scale (VAS) of pain.[176] Although the SF-36 can be used to measure impairments in those with hand eczema, the overall scores are not as predictive as DLQI scores for measures of severity.[175,179] Matterne et al. reported a relationship between severity and Skindex-29 quality-of-life scores.[175]

- **Mental Health:** A series of articles published from one study described the effects of occupational contact dermatitis on anxiety, depression, chronic stress and burnout, that impacted both work and personal life, in a population of patients with failed treatment outcomes.[176,180,181] Patients with occupational hand eczema scored higher on the Hospital Anxiety and Depression Scale (HADS)[176] and on the Shirom-Melamed Burnout Measure (SMBM) compared to the general population;[180] however, scores on the Trier Inventory for Chronic Stress (TICS) were not higher than in a comparison student population.[180]

- **Physical Health:** No studies compared pain, sleeplessness and pruritus in those with occupational contact dermatitis compared to the general population.

- **Disease Diagnosis:** DLQI scores were lower in patients with occupational allergic contact dermatitis than with occupational irritant contact dermatitis.[178]

- **Occupation:** DLQI scores were not statistically different between occupations.[178]

- **Gender:** A series of articles published from one study described the effects of occupational contact dermatitis on gender differences that may be present for variables related to mental and physical health.[180,181] Males with severe hand eczema had significantly higher anxiety and depression scores compared to males with nonsevere hand eczema.[176] Females had significantly greater anxiety than males, which is a trend reflected in the general population as well.[176] In a measure of burnout, only physical fatigue was higher in women.[180] Women were more likely to feel overloaded by work and have heightened worrying, intrusive memories and higher total chronic stress scores than men.[180] At time of admission to the study, women had higher scores related to pain, sleeplessness and pruritus compared to men.[181]

2.7.2 Work Life

Impacts on work life include requiring workplace modifications, sick leave, or a change in job or occupation. No data reviewed reported specifically on impact of occupational contact dermatitis on work relationships. Disease diagnosis (allergic versus irritant contact dermatitis) and occupation were also measured, but no gender differences were reported.

Function at work is often impaired as a result of occupational contact dermatitis.[173,175,178] A follow-up study of occupational skin disease in Western Australia reported that 105 males (15.6%) and 84 females (30%) experienced adverse effects on work.[173] In another study that used the DLQI, work life was more significantly impacted than leisure life.[178] Pain index scores in the SF-36 were associated with severity of disease;[175] thus, increasing severity can lead to increased pain which can, in turn, negatively affect work life.

- **Workplace Modification:** A study reviewed in the BOHRF Guidelines reported that 80% of workers experienced workplace modifications.[49,50] One study reported that only 8% of workers continued work without any changes and most of the workers who did require changes were over age 45.[163] In a six-month follow-up of workers with occupational skin disease, 98 males (21%) and 106 females (19%) changed their work tasks.[141] In a seven-year follow-up study, workplace modification occurred in 54% of workers—most common in workers over age 45, HCWs, dental personnel and farmers.[163] In one study from India, 26 out of 101 workers (25.7%) with occupational contact dermatitis required a change in their level of work.[178]

- **Sick Leave:** Sick leave is common for workers with occupational skin disease.[49,50,141,163,173,177,180] Summarized in BOHRF, the percentage of workers with occupational contact dermatitis reporting impairments related to absence from work of any duration was 6% to 52%.[45,46] Mälkönen and colleagues reported impacts related to sick leave: 138 males (28%) and 138 females (24%) were on sick leave.[141] In a further follow up over seven years, 23% had taken sick leave due to hand eczema.[163] In one study, 583 of those studied (61%) lost time from work due to occupational skin disease and 53 (6.5%) were off for more than 12 months continuously.[173] Another study found that the number of cumulative sick leave days was most impacted by levels of chronic stress (TICS score).[180] In a study out of Germany on the impacts of hand eczema, at least 62.9% of patients reported at least one sick day.[177]

- **Changing Jobs or Occupations:** Definitions for job or occupation change were generally not provided in the studies reviewed. Job change is interpreted as working within the same field, whereas occupation change is interpreted as working in a new field. In one study, 261 males (40%) and 126 females (44%) changed job due to occupational skin disease.[173] BOHRF reported that 9.9% to 48% of workers experienced job change in one study and that 6.5% to 63.5% of workers experienced occupation change in another.[49,50] In a short-term follow-up study by Mälkönen and colleagues, 65 males (14%) and 66 females (12%) changed job or occupation,[141] whereas in the long-term, 34% of workers with occupational contact dermatitis changed occupation and 20% retrained for new occupations (both more common in patients under age 45, and in food-related occupations and hairdressers).

- **Disease Diagnosis:** In a group of workers in India, occupation change was more frequent in those with occupational allergic contact dermatitis versus occupational irritant contact dermatitis.[178]

- **Occupation:** There may be job-specific factors that contribute to a greater likelihood of workplace modification in some jobs (e.g., HCWs) than in other jobs where job or occupation change or job loss due to hand eczema is more common (e.g., hair dressers, food-related occupations).[163]

- **Gender:** No studies identified significant gender effects of occupational contact dermatitis on work life.

2.7.3 Personal Life

Occupational contact dermatitis can impact many facets of personal life. Summarized in BOHRF, the percentage of workers with occupational contact dermatitis reporting impairments in daily function, leisure activities or relationships at home was between 18% and 46%.[49,50] One study from BOHRF reported that 20% of workers reported sleeplessness as a result of pain.[49,50] In addition, pain (measured as high pain index scores on the SF-36) may negatively impact personal life.[175]

- **Disease Diagnosis:** No studies reported differences in the impact of allergic versus irritant contact dermatitis on personal life.

- **Occupation:** No studies reported occupation-specific differences in personal-life impacts.

- **Gender:** From a survey of workers with occupational skin disease, 60% of males and 73% of females stated that occupational skin disease interfered with leisure activities, sexual experiences and social life.[173]

2.7.4 Loss of Employment

A direct consequence of occupational contact dermatitis, especially when untreated, is loss of employment.[49,50,126,140,163,178] According to the BOHRF Guidelines, the percentage of workers with occupational contact dermatitis reporting loss of job or retirement was between 9% and 33%.[49,50] Long-term follow-up by Mälkönen and colleagues reported job loss in 25% of patients (most common in those

over age 45).[163] In a large cohort of 5,324 current and ex-hairdressers, frequency and recency of hand eczema, as well as the presence of atopic dermatitis, were reported to be significant predictors of leaving the trade. Age of onset of hand eczema was not a predictor.[140]

Loss of employment may occur even though treatment is provided. Despite treatment (minor job modification, instruction to avoid suspected irritants and allergens, use of gloves and emollients, and topical corticosteroids), 24 out of 101 (23.8%) patients stopped working.[178]

- **Disease Diagnosis:** Loss of job was more common in patients with allergic contact dermatitis.[163]
- **Occupation:** There may be jobs that are more likely to lead to job loss or occupation changes due to hand eczema. One explanation is that job-specific factors, such as availability of workplace modifications, may decrease job loss or occupation change (e.g., HCWs in health care settings).[163] Loss of job was more common in patients in food-related occupations and hairdressers.[163]
- **Gender:** Mälkönen and colleagues reported that 65 males (14%) and 99 females (17%) lost their job or retired due to their occupational contact dermatitis.[141] Gender was not associated with leaving the trade due to hand eczema in hairdressers.[140]

2.7.5 Economic Impact

There are large costs associated with treatment and management of hand eczema that may be borne by the patient or the health care system.[177] Reported in 2013 and based on cost figures from 2006 to 2008, indirect costs (i.e., productivity loss) accounted for approximately 70% of total costs (which were estimated as €8,799 [approximately $12,882 Canadian dollar] per patient per year).[177] A negative economic impact due to hand eczema was noted in 23% of participants.[163] According to the BOHRF Guidelines, income loss was noted in 7% to 44% of patients, with financial compensation as a common outcome in 41% to 60% of patients.[49,50]

- **Disease Diagnosis:** No studies reported disease-specific differences in economic impact.
- **Occupation:** No studies reported occupation-specific differences in economic impact.
- **Gender:** In a modest sample of patients, 160 males (24%) and 73 females (25%) reported a loss of income due to disability related to their occupational skin disease.[173]

2.7.6 Mitigation of Impact

Treatment programs have positive mitigation of impact on quality of life, work life, personal life and employment in both the short and long term.[68,125,126,134,142,163,176,178,180,181]

- **Quality of Life:** HCWs who participated in a secondary prevention course had improvements in quality of life (54.4% of HCWs had quality-of-life impairment at baseline versus 27.7% at follow-up).[125] Ibler and colleagues reported improvements in DLQI scores following individual consultation (demonstration of hand washing, application of emollients and general skin care

education) and consultation with a physician or dermatologist for severe cases of hand eczema.[68] Bhatia and colleagues reported that workers had significant improvement in quality of life (54.5% improvement in DLQI) at three months following minor job modification, instruction to avoid suspected irritants and allergens, use of gloves and emollients, and topical corticosteroids.[178] Following a two-day, individual prevention program implemented by Schuler and colleagues, HCWs and home workers showed improvements in self-management skills, preventive behaviour, fear of job loss, disease-related symptoms and emotional distress.[134] In another study, participants received health education and counselling for physical and mental health symptoms as part of a three-week, inpatient, tertiary prevention program.[181] The benefits of treatment were noted across several measures of the DLQI, SF-36 and other indices.

- **Work Life:** In HCWs who participated in a two-day, secondary individual prevention course, 44.2% had sick leave due to their skin disease prior to the course versus 14.1% after the course.[125] The course focused on details about skin, risk factors, different types of dermatitis, skin protection, regulations and handling of hazardous substances. At follow-up, 181 (87.9%) remained in the same occupation, 37 (18%) experienced job/occupation change and 37 (18%) had job impairment.[125]

  In a small study of nurses, Chen and colleagues gradually re-introduced workers into their roles, using graduated shifts (fewer patient care shifts per shift cycle, then adding more patient care shifts if tolerated) or hours (fewer patient care hours per shift, then adding more patient care hours per shift, if tolerated).[126] Modified work (e.g., administrative tasks, chart audits, other desk duties) was provided between patient care duties, and workers were educated on precautions to avoid or reduce relevant exposures, as well as appropriate use of personal protective equipment (usually gloves), skin care products and medications. At baseline, six nurses (33%) were providing patient care with modification, 12 (67%) were no longer in patient-care positions and none were off work. After the program 14 (78%) returned to direct patient care with modification, and 3 (17%) were not in patient-care positions.[126] Nine nurses (50%) had lost days at work due to their skin condition.

  In participants of a tertiary individual prevention program, those with greater improvements in OHSI scores had fewer sick days compared those who did not respond as well to the prevention program.[181]

- **Personal Life:** Although no studies explicitly reported on personal life, quality-of-life indicators suggest that personal life is significantly improved by treatment.

- **Loss of Employment:** Many factors lead to job continuation after diagnosis of occupational skin disease. Skudlik and colleagues investigated the correlations between job continuation and various components of a treatment program. For two to three weeks, an almost corticosteroid-free therapy was provided concurrently with educational and psychological intervention. This was followed by a three-week, outpatient phase away from the workplace. Resumption of work occurred after six weeks of dermatology treatment. Job continuation in

high risk professions was more likely as an outcome if patients repeatedly used skin protection measures, were older, continued outpatient therapy, and if their employers provided adequate supply of skin protectant.[142]

Data from a follow-up study in HCWs who participated in a secondary individual prevention course showed significant reduction of impairment due to skin health compared to baseline with improvements in skin care behaviours, but job loss due to skin disease was not completed prevented (reported in 18 cases [8.7%] of cases).[125]

In a small return-to-work program, only one worker was no longer working due to skin disease.[126]

- **Economic impact:** In a long-term follow-up study by Mälkönen and colleagues, healing of hand eczema was associated with less reporting of deteriorated economic situation.[163] It is unclear what type of treatment was received either by those patients with healing and improved economic situation or those who reported continuing deteriorated economic situation. Improvement of economic situation was only seen in 25% of those who changed occupation.[163]
- **Disease Diagnosis:** No studies reported disease-specific differences in the impact of treatment programs.
- **Occupation:** No studies reported on occupation-specific differences in the impact of treatment programs.
- **Gender:** A series of articles published from one study described the effects of an inpatient, tertiary prevention program for individuals with occupational contact dermatitis who failed previous treatment.[176,180,181] Notable differences in quality-of-life impacts related to gender were reported.[181] The stress experience subscale of a chronic stress measure was higher in females than males after treatment, and females experienced greater improvement in the symptoms and feelings subscale of the DLQI.[181]

Based on additional evidence from research questions 18 and 20, and expert opinion, the following recommendation was put forth by the ODHCC.

> **Recommendation:**
>
> 6. Specialized, intensive individual prevention programs, including workplace modification, should be developed for health care workers with moderate to severe occupational contact dermatitis. These programs should use approaches that target improvements in both physical and mental health. (Rating IIIB; research questions 18, 20 and 27)

2.8 Infection Prevention and Control

Research Question 28: Are health care workers with dermatitis at higher risk for skin colonization or skin infection than health care workers without dermatitis?

This research question was included in the RCP Guidelines.[123,124] Three studies were identified consisting primarily of adults and children with atopic dermatitis or broadly categorized eczema who presented at clinics. One small cohort of nurses with or without hand irritation was included. Either by assessing normal skin compared to skin with dermatitis or control populations, measures of methicillin-resistant *Staphylococcus aureus* (MRSA), yeast, gram-negative bacteria and enterococci were taken. The three studies were consistent in reporting that skin with dermatitis is at higher risk for colonization than skin without dermatitis.[123,124]

Albrich and Harbarth identified damaged skin as a risk factor for MRSA carriage in HCWS.[182] More recently, Brans et al. investigated the prevalence of colonization with MRSA in 319 nurses with occupational skin disease.[183] The majority of the nurses suffered from hand eczema (90.3%). Forty-three nurses (13.5%) were found to be colonized with MRSA, a rate that is two to three times higher than previously reported in HCWs. The hand eczema was, on average, significantly more severe in MRSA carriers than in noncarriers. It is not known whether MRSA exacerbated the severity of occupational skin disease, or whether MRSA colonization was more likely due to the increase skin damage. In the latter, it is possible that MRSA colonization could lead to hand hygiene being less effective, that colonized HCWs could be less likely to perform hand hygiene, and/or that the skin condition could provide a more beneficial environment for MRSA colonization. The results of the study suggest that prevention and treatment of occupational skin disease could be important elements in reduction of colonisation with MRSA among nurses and in reduction of transmission to others.

One case-control study determined colony counts and antimicrobial susceptibility testing of microorganisms from hands of HCWs before and after washing hands with nonantimicrobial liquid soap and water in healthy participants (control) and participants with damaged skin (case).[184] The definition and distinction of damaged skin was not clear since the authors stated that these individuals did not have skin disease (i.e., eczema or psoriasis). For interpretation of this study, it was assumed that eczema referred to atopic dermatitis and that inclusion of participants was aimed at capturing those with irritant contact dermatitis as a result of work exposures rather than underlying disease. Participants were also volunteers, so the selection bias of participants needs to be strongly considered. Generally, data showed a nonsignificant trend that damaged hands have higher microbial counts, both before and after hand washing (4.28 versus 3.55 $\log_{10}$ CFU before and 3.75 versus 3.35 $\log_{10}$ CFU after, in damaged versus healthy hands, respectively). Specific microorganism counts and presence of antimicrobial resistant organisms may be higher or lower on damaged hands compared to healthy hands, but in the majority of instances the frequency of detection of a specific microorganism was higher for damaged hands. The current literature search identified updated evidence that was consistent with the recommendation put forth in the RCP Guidelines; the RCP recommendation was accepted by the ODHCC without modification.

Recommendation:

23. Health care practitioners should advise health care workers with dermatitis that areas of skin affected by dermatitis are more likely than normal skin to be colonized with microorganisms, and that this risk is higher with more acute and more severe lesions. (Rating IIA; research question 28)

Research Question 29: Are health care workers with dermatitis more likely to transmit infections to patients than health care workers without dermatitis?

This research question was included in the RCP Guidelines.123,124. No articles were identified in the initial search strategy by the RCP. Their search was expanded to capture case reports and case series. The expanded search identified two case reports that described transmission of microorganisms causing infection linked to a HCW with chronic hand dermatitis and dermatitis of the eye lids and behind the ears. A third epidemiological study of an outbreak identified six HCWs carrying the strain, but only one had dermatitis (described as localised infected eczema). An unpublished case report was noted with transmission linked to a nurse with dermatitis.

Michiels et al. swabbed general practitioners (GPs) and their patients to detect *Staphylococcus aureus* (SA) and community-acquired methicillin-resistant *Staphylococcus aureus* (CA-MRSA). Chronic skin conditions were not significantly associated with either a positive or negative effect in patients, but carriage in patients was more likely if their GP had a chronic skin condition. It was unclear whether GP SA carriage had an effect on transmission to patients and how chronic skin condition of the GP affected transmission potential, if at all.[185]

In a 2008 review of literature, Albrich and Harbarth presented evidence that transmission of MRSA from HCWs to patients was linked to HCWs with skin conditions, including hand eczema. Conversely, other reports document this transmission from HCWs without skin conditions. In studies where transmission of infection from HCWs with skin conditions has been identified, this transmission has not been quantified.[186,187]

The current literature search did not identify updated evidence to inform the recommendation put forth in the RCP Guidelines; however, the expert opinion described below provides rationale for the theoretical basis for transmission. Microbiology and dermatology experts informing the RCP Guidelines agreed that a precautionary approach accounting for the potential risk of transmission of microorganisms that could colonize or cause infection but maintaining HCWs' desire to remain in their job was justifiable. This balance applies precautionary temporary redeployment for HCWs with moderate to severe dermatitis who provide direct patient care in high risk patient populations (e.g., neonates, severely immunocompromised patients, patients in intensive care or post-operative units). Also, in outbreaks where risk of transmission could increase with nonintact skin, HCWs with dermatitis may be temporarily redeployed to work that does not involve direct patient care. Where possible, redeployment decisions are made in consultation with occupational health and safety and infection prevention and control health care professionals.

The proposed recommendations were informed by expert opinion, evidence presented here and from research questions 24, 26 and 28.

Recommendations:

24. Health care practitioners should advise health care workers with dermatitis, who may be at increased risk for colonization, that there is a potential risk they are more likely than health care workers who do not have dermatitis to transmit microorganisms that could colonize or cause infection (e.g., methicillin-resistant *Staphylococcus aureus*) to patients. (Rating IIIA; research question 29)

25. For health care workers who have hand dermatitis, health care practitioners may recommend, during disease outbreaks, temporary redeployment to jobs that do not involve direct patient care. For health care workers who have moderate to severe dermatitis and provide direct care to patients who are at increased risk for infection (e.g., neonates, severely immunocompromised patients, patients in intensive care or post-operative units), temporary redeployment may be recommended until symptoms resolve or are reclassified as mild. (Rating IIIB; research question 29)

3. Future Research

Based on the current literature search, the ODHCC has identified the following areas as priorities for future research:

Seasonal variation (see Background, section 1.6):

- Overall, data from cohort and epidemiological studies regarding seasonal effects related to contact dermatitis are limited and further research is needed.[76]

Personal risk factors at preplacement (see research question 1):

- Personal risk factors that contribute to the development of occupational contact dermatitis in health care workers (HCWs) remain unclear, and supporting evidence is weak and often conflicting. Understanding their personal risk factors may allow HCWs to be better informed at preplacement.

Skin health surveillance (see research question 8):

- No studies have reported on use of skin health surveillance to prevent or detect occupational contact dermatitis. The limited availability of tools for the detection of mild occupational contact dermatitis may make rapid identification, timely reporting, and reaction to trends in incidence and prevalence more difficult.

Optimal skin screening frequency (see research question 9):

- There is a significant economic burden associated with occupational contact dermatitis arising from medical care costs, loss of productivity and time off work.[46] Future research that compares the cost of conducting screening with the cost savings associated with earlier diagnosis would help to inform recommendations on optimal screening frequency.

Prework (barrier) creams (see research question 12):

- The role of barrier creams in health care settings remains controversial. Additional studies are required to determine whether benefits do exist from their use and what harms may result. More information on product formulation–specific outcomes may provide guidance for future recommendations.

Use of paper towels in hand hygiene best practices (see research questions 14, 16 and 18):

- This review did not identify evidence surrounding the type(s) of paper towel that could be used to dry hands in health care settings. Choosing a paper towel with good absorbency is important, but it is not clear how to determine whether a paper towel product will cause irritation with use.

Cotton glove liners for prevention (see research question 22):

- Studies comparing HCWs with healthy skin using cotton glove liners to controls not using cotton glove liners will help to inform when cotton glove liners should be used to prevent occupational contact dermatitis. Additional studies comparing HCWs with hand dermatitis using cotton glove liners to controls not using cotton glove liners would provide an important evidence base. Currently, only expert opinion exists on the benefits of cotton glove liners for secondary and tertiary prevention of occupational contact dermatitis.

Benefits of cotton glove liners (see research question 23):

- Future research on the benefits of use of glove and cotton glove liners would benefit from measuring the use of gloves during appropriate indications for their use and from studying HCWs with and without current symptoms. It would also be helpful to ascertain whether wearing cotton glove liners has a negative impact on manual dexterity that would be required for HCWs to perform specific job tasks. HCWs might be less inclined to use cotton glove liners if they detract from required manual dexterity.

Diagnostic criteria (see research question 24):

- A comprehensive set of tools enabling early recognition of mild occupational contact dermatitis and an algorithm for diagnostic classification of irritant contact dermatitis versus allergic contact dermatitis would aid identification and proper treatment of HCWs affected with occupational contact dermatitis and improve the quality of data reporting.

- Reported literature shows a minimal benefit of custom patch testing. Identification and testing of haptens not present in standard trays relevant to the health care setting should be investigated further to confirm additive value of custom patch testing.

Clinical prognosis (see research question 26):

- Factors impacting prognosis could be explored further to determine if certain individuals may require more intensive, individual prevention programs than others to increase positive outcomes of treatment.

Infection transmission (see research question 29):

- More research is required to determine the association between dermatitis and infection transmission. Reports of transmission of health care–associated infections should include information on whether dermatitis of the hands is indicated as a source of transmission. Furthermore, to establish an evidence base for the association between dermatitis and transmission, these reports should consider reporting how many individuals were screened and how many had dermatitis (either diagnosed or newly detected based on the outbreak investigation). The type of screening used should also provide genetic typing to increase confidence of the epidemiological link for transmission.

Appendix A: Infection Prevention and Control Practices for Occupational Contact Dermatitis

Table 18. Infection Prevention and Control Practices for Occupational Contact Dermatitis

Skin Condition	Definition	Hand Hygiene	Glove Use	Patient Care
Normal skin	No abnormalities	ABHR preferred ABHR with emollients moisturizes skin	Follow Routine Practices and Additional Precautions[§]	No work restrictions Hand hygiene in alignment with patient care needs
Mild dermatitis	Dryness, mild erythema	ABHR preferred ABHR with emollients moisturizes skin	Follow Routine Practices and Additional Precautions[§]	No work restrictions Hand hygiene in alignment with patient care needs
Mild to moderate dermatitis	Dryness, erythema and cracking	ABHR preferred ABHR with emollients moisturizes skin	Cotton glove liners may be used, and glove use follows Routine Practices and Additional Precautions[§]	No work restrictions Hand hygiene in alignment with patient care needs
Moderate dermatitis	Dryness, moderate erythema, cracking and scaling with or without some minor vesicles	Soap and water preferred ABHR can be stinging	Cotton glove liners are recommended, and glove use follows Routine Practices and Additional Precautions[§]	Limit direct patient care Hand hygiene requirements for patient care are met with soap and water

Skin Condition	Definition	Hand Hygiene	Glove Use	Patient Care
Moderate to severe dermatitis	Moderate dryness and erythema, cracking, scaling and weeping vesicles	Wash hands with soap and water	Minimize or avoid glove use	Remove from direct patient care
Severe dermatitis	Severe dryness and erythema, cracking, fissures and weeping vesicles	Wash hands with soap and water	Avoid glove use	Remove from direct patient care

Abbreviations: ABHR = Alcohol-based hand rub

[§] Ontario Agency for Health Protection and Promotion (Public Health Ontario), Provincial Infectious Diseases Advisory Committee. *Routine practices and additional precautions in all health care settings*. 3rd ed. Toronto, ON: Queen's Printer for Ontario; 2012.

Adapted from:

1. Canadian Centre for Occupational Health and Safety. OSH answers fact sheets: dermatitis, irritant contact [Internet]. Hamilton, ON: Canadian Centre for Occupational Health & Safety; 2016 [cited 2018 Nov 28]. Available from: https://www.ccohs.ca/oshanswers/diseases/dermatitis.html

2. Canadian Centre for Occupational Health and Safety. OSH answers fact sheets: dermatitis, allergic contact [Internet]. Hamilton, ON: Canadian Centre for Occupational Health & Safety; 2016 [cited 2018 Nov 28]. Available from: https://www.ccohs.ca/oshanswers/diseases/allergic_derm.html

Appendix B: Occupational Irritants and Allergens

Table 19. Irritants and Allergens Encountered in High-Risk Occupations

Occupation	Irritants	Allergens
Agriculture workers	Artificial fertilizers, cleaners, diesel oil, disinfectants, gasoline, pesticides, plants and grains	Animal feed, barley, cement, plants, pesticides, oats, rubber, veterinary medications, wood preservatives
Artists	Clay, plaster, solvents	Colophony, dyes, epoxy resin, pigments, turpentine
Automobile and aircraft industry workers	Cutting oils, hand cleansers, paints, solvents	Cobalt, chromates, epoxy and dimethacrylate, nickel, rubber
Bakers and confectioners	Detergents, flour	Ammonium persulfate, benzoyl peroxide, dyes, essential oils, flavours, lemon, orange, spices
Bartenders	Detergents, wet work	Flavours, lemon, lime, orange
Bookbinders	Glues, solvents	Glues, leathers, resins
Butchers	Detergents, meat, waste	Nickel, sawdust
Cabinet makers, and carpenters	Detergents, glues, solvents, thinners, wood preservatives	Colophony, glues, stains, turpentine, varnishes, woods
Cleaners	Detergents, solvents, wet work	Preservatives (e.g., butylated hydroxytoluene), fragrances, rubber gloves[¶]
Coal miners	Dust (e.g., coal, stone), wet conditions	Rubber boots and masks
Construction workers	Cement	Chromates, cobalt, resins, rubber and leather gloves, woods

Occupation	Irritants	Allergens
Cooks and caterers	Detergents, vegetable juices, wet work	Foods, flavours, formaldehyde, garlic, lauryl and octyl gallate, onions, rubber gloves, ¶ sodium metabisulfite, spices
Dentists and dental technicians	Detergents, hand cleansers, wet work	Dental impression material, disinfectants, eugenol, local anesthetics, mercury, methacrylates (e.g., methylmethacrylate), rubber
Dry cleaners	Solvents	Rubber gloves¶
Electricians	Soldering fluxes	Fluxes, resins, rubber
Electroplaters	Acids, alkalis	Chromium, cobalt, nickel
Embalmers		Formaldehyde
Floor layers	Solvents	Cement, resins, varnish, woods
Florists and gardeners	Artificial fertilizers, manure, pesticides, wet work	Pesticides, plants, rubber gloves¶
Foundry workers		Colophony, phenol-and urea-formaldehyde resins
Hairdressers	Bleaching agents, permanent wave solutions, shampoos, wet work	Dyes, formaldehyde, nickel, fragrances, persulfates, preservatives (e.g., methylisothiazolinone), pyrogallol, resorcinol, rubber gloves¶
Health care workers and medical personnel	Cleaning agents, detergents, disinfectants, foods, hand cleansers, heat, perspiration, wet work	Local anesthetics, antibiotics, antiseptics, dental materials, excipients and fragrances in hand care products, formaldehyde, glutaraldehyde, preservatives (e.g., butylated hydroxytoluene), rubber gloves, ¶ liquid chloroxylenol, phenothiazines
Homemakers	Cleansers, detergents, foods, wet work	Chromates, flavours, foods, nickel, polishes, rubber gloves, ¶ spices
Jewellers	Detergents, solvents	Epoxy resin, metals, soldering fluxes
Mechanics	Cleaners, diesel fuel, gasoline, greases, oils, solvents	Antifreeze, chromates, epoxy resin, rubber gloves¶

Occupation	Irritants	Allergens
Metal workers	Cutting oils, hand cleaners, solvents	Additives in some cutting oils, chromates, nickel
Office workers	Solvents, photocopiers, adhesives	Glue, nickel, rubber
Painters	Hand cleansers, solvents, thinners, wallpaper adhesives	Adhesives, chromates, cobalt, epoxy resin, formaldehyde, paints, polyester resins, preservatives (e.g., methylisothiazolinone, methylchloroisothiazolinone), thinners, turpentine
Photography industry workers	Solvents, wet work	Chromates, colour developers, formaldehyde, hydroquinone, para-aminophenol, rubber gloves, ¶ sodium metabisulfite
Plastics workers	Acids, oxidizing agents, solvents, styrene	Acrylics, hardeners, phenolic resins, plasticizers, polyurethanes
Printers	Solvents	Chromates, cobalt, colophony, formaldehyde, nickel, turpentine
Rubber workers	Solvents, talc, uncured rubber, zinc stearate	Colophony, dyes, rubber chemical
Shoemakers	Solvents	Glues, leather, rubber, turpentine
Tannery workers	Acids, alkalis, reducing and oxidizing agents, wet work	Chromates, dyes, formaldehyde, fungicides, tanning agents
Textile workers	Bleaching agents, fibres, solvents	Chromates, dyes, formaldehyde, nickel, resins
Veterinarians and slaughterhouse workers	Animal entrails and secretions, disinfectants, wet work	Rubber gloves, ¶ medicaments

¶ Natural rubber latex and chemical accelerators in rubber

Source:

1. Canadian Centre for Occupational Health and Safety. OSH answers fact sheets: dermatitis, irritant contact [Internet]. Hamilton, ON: Canadian Centre for Occupational Health & Safety; 2016 [cited 2018 Nov 28]. Available from: https://www.ccohs.ca/oshanswers/diseases/dermatitis.html
2. Canadian Centre for Occupational Health and Safety. OSH answers fact sheets: dermatitis, allergic contact [Internet]. Hamilton, ON: Canadian Centre for Occupational Health & Safety; 2016 [cited 2018 Nov 28]. Available from: https://www.ccohs.ca/oshanswers/diseases/allergic_derm.html

Appendix C: Glove Selection Guide

The hands of health care workers (HCWs) are exposed to various hazards in the workplace. The most common exposure is wet work, including frequent hand washing and gloving, which may increase the risk of irritant contact dermatitis. Other exposures (e.g., natural rubber latex, rubber accelerators) may cause allergic contact dermatitis. Cleaning chemicals, cytotoxic drugs and bloodborne pathogens are also common exposures. Cut and puncture risks may be present in some tasks. In North America, certification for gloves with puncture resistance typically uses ASTM (F1342-05, F1790-15, F2878-19) or ANSI (105-2016). If no certification is present, the HCW can expect zero to minimal protection against these hazards. For improved cut and penetration protection there may be a loss of manual dexterity. Even for gloves of the same material, protection may also be influenced by thickness and manufacturing quality. Maintaining skin integrity is the key to prevention for both acquiring and transmitting microorganisms.

Considerations for exposure risks and outcomes, glove selection for the task, and best practices for hand hygiene are presented for all glove types overall [ASTM D7103-18], as well as for individual glove types.

C.1 All Glove Types

Exposure Risks and Outcomes

When performing any task, HCWs should refer to safety data sheets to select gloves that are appropriate for the exposures related to that task. See Table 20 for a list of risks and possible outcomes based on those risks.

Table 20. Exposure Risks and Possible Outcomes

Exposure Risks	Possible Outcomes
Cleaning agents, detergents, disinfectants, foods, hand cleansers, heat, perspiration, wet work	Irritant contact dermatitis
Local anesthetics, antibiotics, antiseptics, dental materials, excipients and fragrances in hand care products, formaldehyde, glutaraldehyde, liquid chloroxylenol, local anesthetics, phenothiazines, preservatives (e.g., butylated hydroxytoluene), rubber gloves (rubber accelerators)	Allergic contact dermatitis and allergic contact urticaria from latex in rubber gloves
Hazardous drugs, cytotoxic agents	Carcinogenicity, teratogenicity, or other developmental, reproductive or organ toxicity
Bloodborne pathogens	Hepatitis B, hepatitis C or HIV infection

Glove Selection for Task

To reduce the risk of exposure to wet work and natural rubber latex, HCWs should select gloves based on risk assessment.

Bloodborne pathogen exposures may require additional considerations for glove selection:

- For tasks with high risk of glove punctures (e.g., orthopedics), double gloving may offer additional protection.
- When the risks of puncture cannot be adequately controlled by applying the hierarchy of controls, puncture-resistant gloves should be used. Previous test methods for measuring puncture resistance for gloves [ASTM F1342-05(2013)e1; ANSI/ISEA 105-2016] did not reflect a puncture hazard associated with a hypodermic needle found in health care settings. The puncture probes used in these tests lack the sharp, cutting edge of a hypodermic needle. New test methods specific to hypodermic needles [ASTM F2878-19] are available, and gloves meeting these standards should be used when tasks involve risk of punctures from needles. Cut resistance [ASTM F1790M-15; ANSI/ISEA 105-2016] is a property of gloves separate from puncture resistance. If risk of cuts cannot be avoided, gloves with cut resistance should be considered.
- An extended cuff may be needed for different tasks (e.g., chemotherapy, endoscopy, obstetrics).

In addition to appropriate glove selection to reduce the risk of contracting bloodborne infections, employers should ensure:

- HCWs are effectively vaccinated against hepatitis B (post-vaccination level of antibody against hepatitis B is greater than 10 IU/L).
- Education and follow-up on sharps injury prevention are provided.

Best Practices for Hand Hygiene

For all types of gloves, HCWs should follow best practices for hand hygiene:

- Follow the hand hygiene program requirements of their institution.
- Use alcohol-based hand rub with emollients when hands are not visibly soiled.
- Wash hands with soap and running water if hands are visibly soiled.
- Avoid antibacterial soaps (e.g., triclosan).
- Use emollient hand lotions regularly; these should be free of allergens (e.g., fragrances, formaldehyde, isothiazolinone).
- Wear gloves only as needed.
- Remove gloves and glove liners and perform hand hygiene immediately following completion of a task or before exiting the patient environment.

C.2 Individual Glove Types

The exposure risks and outcomes, considerations for glove selection and best practices for hand hygiene for different glove types is presented in Table 21.

Table 21. Exposure Risks and Outcomes, Glove Selection for the Task, and Best Practices for Hand Hygiene, for General Health Care, Surgical, General Cleaning, Chemotherapy and Food Service Gloves

Glove Type	Exposure Risks and Outcomes	Glove Selection for the Task	Best Practices for Hand Hygiene
General Health Care Duty Gloves 	See Exposure Risks and Outcomes.	When selecting health care duty gloves, HCWs should consider: • Vinyl is satisfactory for shorter duration activities (ISO 11193-2:2006; ASTM D5250-06[2015]). • Nitrile (ISO 11193-1:2008; ASTM D6319-10[2015]) is recommended for longer duration activities. • Polychloroprene (ASTM D6977-04[2016]) is an alternative to nitrile. • Latex (low protein and powder-free (ISO 11193-1:2008; ASTM D3578-05[2015]) is generally not recommended due to allergy risk to HCWs and patients.	See Best Practices for Hand Hygiene.
Surgical Gloves 	See Exposure Risks and Outcomes.	When selecting surgical gloves, consider the following: • Synthetic gloves (e.g., nitrile or neoprene [ISO 10282:2014; ASTM D3577-09{2015}]) are preferred to latex. • If synthetic gloves are not available, use of latex (ISO 10282:2014; ASTM D3577-09[2015]) must be of low protein and powder-free and should not be in the vicinity of individuals with latex allergy.	HCWs should consider: • avoiding abrasive scrub brushes • alcohol-based, pre-operative surgical hand preparation

Glove Type	Exposure Risks and Outcomes	Glove Selection for the Task	Best Practices for Hand Hygiene
General Cleaning Gloves 	HCWs may be at risk of the following outcomes from exposure to chemicals: • sensitization to chemicals (e.g., quaternary products) • irritation (e.g., sodium hypochlorite) • irritant contact dermatitis	• General cleaning gloves are rated for degradation, breakthrough time and permeation rates. When selecting general cleaning gloves, HCWs should choose those that provide the best resistance to the chemical being used. Gloves should be replaced at a frequency appropriate to the ratings of the glove or if damaged or contaminated. • In addition, nitrile (ISO 11193-1:2008; ASTM D6319-10[2015]) is recommended for wet work of long duration and for contact with certain chemical powders and solutions (refer to manufacturer safety data sheets).	See Best Practices for Hand Hygiene

Glove Type	Exposure Risks and Outcomes	Glove Selection for the Task	Best Practices for Hand Hygiene
Chemotherapy Gloves 	HCWs may be exposed to hazardous drugs and cytotoxic agents; these exposures may lead to carcinogenicity, teratogenicity or other developmental toxicity, reproductive toxicity or organ toxicity.	HCWs should ensure that the glove has been tested against the drugs they are administering. Note also: • Approved chemotherapy nitrile gloves (ASTM D6978-05[2019]) prevent cytotoxic agent penetration. This applies primarily to pharmacy, nursing or others handling cytotoxic agents (e.g., physician, learner, receiver, spills team). • If latex gloves are used, choose those that are of low protein and powder-free (ASTM D6978-05[2019]) and ensure that no individuals in the vicinity of their use have allergies to latex. • Polyurethane and neoprene (ASTM D6978-05[2019]) gloves may be used if they have been approved as chemotherapy gloves. Double gloving, according to Cancer Care Ontario, should be used for the following tasks: • receiving, unpacking and cleaning of packaging/vials • sterile preparations • preparing creams, ointments, oral solutions and crushing tablets • topical administration • cleaning up spill or damaged or broken container • cleaning of preparation cabinets Alternatively, thicker gloves may be worn. The thickness required depends on the material of the glove.	Best practices for hand hygiene when using chemotherapy gloves include: • Wear chemotherapy gloves suitable for the task. • Change gloves every 30 minutes or less or as indicated by the manufacturer's instructions according to the agent. • Following safe removal of gloves, wash hands with soap and water, and thoroughly rinse.

Glove Type	Exposure Risks and Outcomes	Glove Selection for the Task	Best Practices for Hand Hygiene
Food Service Gloves (Sandwich Gloves) 		Food service gloves (sandwich gloves) (ASTM D7329-07[2018]) should only be used for food handling.	

C.3 Relevant Standards for Glove Certification (North America)

The Canadian General Standards Board (CGSB)

- *ISO 10282:2014: Single-Use Sterile Surgical Rubber Gloves*
- *ISO 11193-1:2008: Single-Use Medical Examination Gloves—Part 1: Gloves Made from Rubber Latex or Rubber Solution*
- *ISO 11193-2:2006: Single-Use Medical Examination Gloves—Part 2: Polyvinyl Chloride Gloves for Medical Application*

ASTM International

- *D3577-09(2015): Standard Specification for Rubber Surgical Gloves*
- *D3578-05(2015): Standard Specification for Rubber Examination Gloves*
- *D5250-06(2015): Standard Specification for Polyvinyl Chloride Gloves for Medical Application*
- *D6319-10(2015): Standard Specification for Nitrile Examination Gloves for Medical Application*
- *D6977-04(2016): Standard Specification for Polychloroprene Examination Gloves for Medical Application*
- *D6978-05(2019): Standard Practice for Assessment of Resistance of Medical Gloves to Permeation by Chemotherapy Drugs*
- *D7103-18: Standard Guide for Assessment of Medical Gloves*
- *D7329-07(2018): Standard Specification for Food Preparation and Food Handling (Food Service) Gloves*
- *F1342-05(2013)e1: Standard Test Method for Protective Clothing Material Resistance to Puncture*
- *F1790M-15: Standard Test Method for Measuring Cut Resistance of Materials Used in Protective Clothing with CPP Test Equipment*
- *F2878-19: Standard Test Method for Protective Clothing Material Resistance to Hypodermic Needle Puncture*

American National Standards Institution (ANSI)

- *ANSI/ISEA 105-2016: Hand Protection Classification*

C.4 Additional Resources

- Provincial Infectious Diseases Advisory Committee. 2014. *Best Practices for Hand Hygiene in All Health Care Settings*. 4th edition.
- Provincial Infectious Diseases Advisory Committee. 2012. *Routine Practices and Additional Precautions in All Health Care Settings*. 3rd edition.
- Smith S. EHS today. 2014 Feb 24. Understanding Cut-Resistant Levels [Infographic].
- Vrshek E. Industrial safety & hygiene news. 2014 Feb 3. *ANSI and EN Cut and Puncture Testing*.
- Association paritaire pour la santé et la sécurité du travail du secteur affaires sociales (ASSTSAS). 2007. *Prevention Guide—Safe Handling of Hazardous Drugs*.
- Easty A, Coakley N, Cheng R, Cividino M, Savage P, Tozer R, et al. 2013. *Safe Handling of Cytotoxics*.
- U.S. Food and Drug Administration. 2018 Aug 22. *Medical Devices. Medical Gloves*.

Appendix D: Glove Selection Checklist

D.1 Essential Criteria

The following essential criteria can be applied as a checklist to ensure proper glove selection:

1. **Appropriate to the task** (e.g., surgical, general health care duty, chemotherapy, general cleaning)
    - sterile versus nonsterile procedure
2. **Good fitting characteristics**
    - available in different sizes
    - easy to put on (don) and remove (doff)
    - fit snugly around the wrist for use with a gown
    - have extended cuff length as needed (e.g., chemotherapy, endoscopy, obstetrics)
    - meet dexterity requirements
3. **Barrier integrity**
    - meet requirements based on exposure risk assessment
        - acids and bases, salts, alcohols, oils and greases
        - cytotoxics
        - wet work
        - blood and bodily fluids
        - physical forces (cuts, punctures [needles or blunt objects], friction)
    - anticipate duration of use (e.g., quick procedure versus lengthy operative procedure)
4. **Glove certification**
    - Packages should be marked with the corresponding Canadian General Standards Board (CGSB), ASTM International, American National Standards Institution (ANSI) or equivalent certification for claims made by the manufacturer (e.g., puncture resistance to hypodermic needles, specific chemical resistance).

- "Powder-free" must have less than two milligrams of powder per glove and must have less than 50 parts per million of protein per glove.
- Powdered medical latex gloves must have less than 250 parts per million of protein per glove.

5. **Acceptability to users**
    - comfortable to wear
    - preferred choice
    - should not contain allergens to which the user is allergic (e.g., natural rubber latex, rubber accelerators)
    - latex gloves should not be worn in the vicinity of individuals with latex allergy

D.2 Additional Resources

- Provincial Infectious Diseases Advisory Committee. 2012. *Routine Practices and Additional Precautions in All Health Care Settings*. 3rd edition.
- Smith S. EHS today. 2014 Feb 24. Understanding Cut-Resistant Levels [Infographic].
- Vrshek E. Industrial safety & hygiene news. 2014 Feb 3. *ANSI and EN Cut and Puncture Testing*.
- Association paritaire pour la santé et la sécurité du travail du secteur affaires sociales (ASSTSAS). 2007. *Prevention Guide—Safe Handling of Hazardous Drugs*.
- Easty A, Coakley N, Cheng R, Cividino M, Savage P, Tozer R, et al. 2013. *Safe Handling of Cytotoxics*.
- U.S. Food and Drug Administration. 2018 Aug 22. *Medical Devices. Medical Gloves*.

Appendix E: Cotton Glove Liner Selection Guide

Gloves may be considered a hazard contributing to occupational contact dermatitis when allergies to glove components (e.g., natural rubber latex, rubber accelerators), long duration of use, or existing skin conditions are present. Long-duration wearing of occlusive gloves may contribute to moisture in the glove (sweating) which can have a negative effect on skin barrier function[104] that could be improved with wearing cotton glove liners. Individuals with allergic contact dermatitis or irritant contact dermatitis may benefit from the use of cotton glove liners worn beneath the task glove (see Figure 11).

- Single use (disposable) 100% cotton glove liners are commonly used in health care settings.
- Reusable cotton glove liners are occasionally used, typically in an operative room setting. For cotton glove liners to be reused, they must be classified as reusable and be reprocessed according to manufacturer's instructions. Reusable cotton glove liners should be disposed of if damaged (e.g., excessive wear, tears, pilling)[188] or when the number of uses meets the manufacturer's indicated instructions for disposal.
- Cotton glove liners do not replace other specialty glove liners, such as surgical glove liners or cut-resistant liners.

Figure 11. Single Use Cotton Glove Liner (left) with Nitrile Glove (right)

In addition, the following considerations are important to be aware of when selecting cotton glove liners:

- A variety of sizes are offered to meet the needs of the HCWs.
- Acceptability to users should be considered (e.g., comfort and ability to perform tasks).
- Glove liners should be changed when gloves are changed.
- Sterile cotton glove liners are used with sterile gloves for sterile procedures.**
- Single use cotton glove liners should never be reused; dispose after each use.**

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Appendix F: Screening and Severity Assessment Tools

A variety of screening tools (see Table 22) and severity assessment tools (see Table 23) were identified in the review of literature for this report.

Table 22. Occupational Contact Dermatitis Screening Tools Used in Identified Studies

Questionnaire/Survey	Acronym	Description
Nichol et al. Hand Dermatitis Screening Tool		Self-reported or used by an occupational health nurse, this tool includes a photo guide to assist in appropriately classifying skin condition into three categories: normal skin, mild hand dermatitis and moderate/severe hand dermatitis.
Nordic Occupational Skin Questionnaire	NOSQ-2002	Self-reported questionnaire, available in two versions. NOSQ-2002/SHORT is a 4-page questionnaire that includes 14 questions used for screening and monitoring of occupational skin diseases on hands and forearms. NOSQ-2002/LONG is a 19-page questionnaire consisting of 57 questions that includes all questions of the short version plus additional detailed questions related to skin condition, quality of life and risk factors. The long version is typically used for research purposes.

Table 23. Occupational Contact Dermatitis Severity Assessment Tools Used in Identified Studies

Questionnaire/Survey	Acronym	Description
Hand Eczema Score for Occupational Screenings	HEROS	Used by physicians to quantify minimal skin impairment in early hand eczema.
Hand Eczema Severity Index	HECSI	Used by physicians to measure hand eczema severity. Incorporates both intensity and extent of disease.
Occupational Contact Dermatitis Disease Severity Index	ODDI	Used by physicians to assess disease severity and functional disability due to occupational contact dermatitis.
Osnabrueck Hand Eczema Severity Index	OHSI	Used by physicians to measure severity of hand eczema by assessing morphological signs (erythema, scaling, papules, vesicles, infiltration, fissuring).
Physician's/Investigator's Global Assessment	PGA or IGA	Used by physicians to rate disease activity (severity), from no disease activity to most severe activity. The scale range may vary.
Visual Analogue Scale	VAS	Self-reported measure used to rate the symptoms of a disease from no symptoms to worst possible symptoms. The instrument includes a visual component wherein the ratings can be plotted on a scale that is usually 10 cm in length.

Appendix G: Quality-of-Life Measurement Tools

A variety of quality-of-life measurement tools were identified in the review of literature for this report (see Tables 24 and 25).

Table 24. Skin Disease-Specific Quality-of-Life Measurement Tools Used in Identified Studies

Questionnaire/Survey	Acronym	Description
Dermatology Life Quality Index	DLQI	Self-reported, 10-item tool used to assess a patient's perception of how their skin disease has impacted their health-related quality of life during the previous week.
Deutsche Gesetzliche Unfallversicherung	DGUV	Self-reported questionnaire used to evaluate impacts of individual prevention courses on several aspects of life and work in people suffering from skin disease.
Nordic Occupational Skin Questionnaire	NOSQ-2002	Self-reported questionnaire, available in two versions. NOSQ-2002/SHORT is a 4-page questionnaire that includes 14 questions used for screening and monitoring of occupational skin diseases on hands and forearms. NOSQ-2002/LONG is a 19-page questionnaire consisting of 57 questions that includes all questions of the short version plus additional detailed questions related to skin condition, quality of life and risk factors. The long version is typically used for research purposes.
Skindex-29		Self-reported, 29-item questionnaire used to assess health-related quality of life in patients with skin disease. Includes questions on burden of symptoms, social and physical function, and emotional responses.

Table 25. General Quality-of-Life Measurement Tools Used in Identified Studies

Questionnaire/Survey	Acronym	Description
Health Education Impact Questionnaire	heiQ	Self-reported, 42-item questionnaire used to measure and evaluate outcomes of education and self-management programs in patients with chronic conditions.
Hospital Anxiety and Depression Scale	HADS	Self-reported, 14-item questionnaire used to screen for symptoms of anxiety and depression.
Shirom-Melamed Burnout Measure	SMBM	Self-reported, 14-item questionnaire used to measure job-related burnout.
36-Item Short Form Health Survey	SF-36	Self-reported, 36-item questionnaire used as a measure of health-related quality of life.
Trier Inventory for Chronic Stress	TICS	Self-reported, 57-item questionnaire used to assess chronic stress.

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