

Occupational Contact Dermatitis: Translating Diagnosis into Causation, Prevention, and Fitness-for-Work Decisions

Mafalda Bica Tavares^{1,*}, Martim Luz², João Coutinho de Sousa¹, Renato Matos Barbosa¹, Amanda Dias¹, Rita Gil Duarte¹, Ana Beatriz Oliveira¹, Miguel Magalhães¹, Ana Catarina Carvoeiro¹, Filipe Araújo¹, Ana Sofia Duarte¹, Nuno Augusto Saldanha¹ and Sara Alves Matos¹

¹Occupational Health Service, Unidade Local de Saúde de Santo António, Porto, Portugal

²Dermatology Service, Unidade Local de Saúde de Santo António, Porto, Portugal

***Corresponding author:** Mafalda Bica Tavares, Occupational Health Service, Unidade Local de Saúde de Santo António, Largo do Professor Abel Salazar, 4099-001 Porto, Portugal

Received: October 06, 2026

Published: December 07, 2026

Abstract

Contact dermatitis accounts for approximately 90% of occupational skin disorders, and occupational contact dermatitis constitutes up to 30% of reported occupational diseases. Irritant contact dermatitis, the most common form, results from direct injury to the epidermal barrier, whereas allergic contact dermatitis is a delayed T cell-mediated reaction that requires prior sensitization. The two frequently coexist and are difficult to distinguish clinically, particularly in chronic hand eczema. This mini review approaches occupational contact dermatitis from the perspective of occupational medicine. It summarizes the mechanisms and the diagnostic work-up, including patch testing with workplace materials and the assessment of clinical relevance, and then examines five responsibilities of the occupational physician. These are the attribution of occupational causation or aggravation with the Mathias criteria and the operational definition of Ale and Maibach, exposure assessment against the current definition of wet work, prevention structured as a hierarchy in which elimination, substitution, and technical and organizational controls precede personal protection, a fitness-for-work decision with a graded return to work, and statutory notification of suspected occupational disease. The Portuguese medicolegal framework is used as a worked example of how these steps connect. Identification of the causal agent is only the first stage of management. The decisive task is to translate it into a documented causation judgment, a feasible workplace adaptation, and the appropriate notification.

Keywords: Occupational dermatitis; Allergic contact dermatitis; Irritant contact dermatitis; Patch tests; Wet work; Fitness for work

Introduction

Contact dermatitis is an inflammatory skin condition caused by exposure to exogenous substances and is classified as irritant or allergic [1]. Its prevalence is estimated at 1.7% to 9.8%, it accounts for 4% to 7% of dermatology consultations, and it is more common in women [1]. Approximately 90% of occupational skin disorders in industrialized countries are contact dermatitis, mostly irritant [1], and occupational contact dermatitis constitutes up to 30% of reported occupational diseases [2].

Risk is concentrated in occupations involving wet work and exposure to detergents, disinfectants, metalworking fluids, cement, metals, rubber, and resins, and healthcare workers, hairdressers, food handlers, and construction and metal workers are consistently over-represented [1-3]. Irritant, allergic, and endogenous factors often coexist in the same worker [2].

The dermatological diagnosis of contact dermatitis is well established, but its translation into occupational decisions is less often presented as an integrated sequence. A positive patch test does not by itself establish occupational disease [4], determine work restrictions, or satisfy statutory notification requirements. The occupational physician must link the finding to a documented exposure and translate it into decisions on causation, prevention, fitness for work, and notification. This mini review examines occupational contact dermatitis from the point at which the dermatological diagnosis meets occupational decision-making and uses the Portuguese medicolegal framework as a worked example.

Methods

This narrative mini review is based on a targeted, non-systematic search of MEDLINE through PubMed, using combi-

nations of the terms occupational contact dermatitis, irritant contact dermatitis, allergic contact dermatitis, hand eczema, wet work, patch testing, clinical relevance, occupational causation, fitness for work, return to work, skin protection, and occupational disease notification. The search was last updated in 2026. Current European and German guidelines on patch testing, hand eczema, and occupational skin products [4-7], the German technical rules on skin exposure [8], and the Portuguese legal instruments on fitness for work and occupational disease were also consulted. Priority was given to guidelines, systematic reviews, and reviews published in the past five years. Older publications were retained only when they introduced an instrument that remains in use, namely the Mathias criteria and the operational definition of Ale and Maibach, or when no more recent systematic review was available. Legal instruments and official national guidance were cited in their current versions irrespective of date. Selection and synthesis were performed by the authors without a formal screening protocol or risk-of-bias assessment.

Mechanisms and Clinical Features

Irritant contact dermatitis results from disruption of the epidermal barrier combined with activation of innate immunity, and it requires no prior sensitization [9]. Acute irritant dermatitis follows a single exposure to a potent irritant and causes burning, stinging, and soreness, whereas irritants such as benzalkonium chloride may produce a delayed reaction 8 to 24 hours after exposure that can be mistaken for allergy [9]. The most common occupational form results from repeated exposure to weak irritants or wet work over a long period [2], when the interval between exposures is too short for recovery of barrier function [9]. In a systematic review, the evidence for an association with irritant contact dermatitis was strong for wet work, moderate for detergents and non-alcoholic disinfectants, and strong for their combination [3]. Occlusion, heat, sweating, and friction increase irritation, and frictional damage enhances the penetration of allergens [9].

Allergic contact dermatitis is a type IV delayed hypersensitivity reaction that develops in two phases [1]. In the sensitization phase, haptens bind skin proteins and are presented by Langerhans cells and dermal dendritic cells to naive T cells in regional lymph nodes. On re-exposure, the elicitation phase produces dermatitis, usually within 24 to 48 hours [1]. In a North American analysis of occupational allergic contact dermatitis, the most common clinically relevant allergens were rubber accelerators, methylisothiazolinone, epoxy resin, formaldehyde, nickel, potassium dichromate, 2-hydroxyethyl methacrylate, and cobalt [2].

The two forms often cannot be distinguished on clinical grounds alone, particularly in chronic hand dermatitis (**Table 1**) [2,9]. Irritant contact dermatitis is therefore a diagnosis of exclusion, established from the exposure history, the distribution of lesions, and negative patch test results [9]. A positive patch test confirms sensitization but does not exclude a concurrent irritant component [2]. Allergen avoidance alone may therefore fail to resolve the dermatitis if wet work and other irritant exposures are not reduced at the same time.

Diagnosis and Clinical Relevance

The occupational history distinguishes an occupational assessment from a dermatological one and should be documented in detail, because it may later be required for medicolegal purposes [4]. It should record current and previous jobs, the tasks performed, the materials handled with reference to safety data sheets, the personal protective equipment used, similar complaints among co-workers, and the course of symptoms during holidays and rest days [2,4]. Safety data sheets are often incomplete but guide the selection of workplace materials for testing [2]. Non-occupational exposures must be recorded with equal care, and topical treatments may themselves cause secondary contact dermatitis [2].

Patch testing is the reference standard for the diagnosis of allergic contact dermatitis [1,4]. The baseline series detects most, but not all, occupational contact allergies. In a North American analysis, 18% of patients with occupational allergic contact dermatitis reacted to supplemental allergens, including 5% who reacted only to them [2]. The European baseline series should therefore be supplemented by occupation-specific series and by the worker's own products at appropriate non-irritant concentrations, and testing with workplace materials has been reported to yield almost 20% additional diagnoses of occupational allergic contact dermatitis [4]. Unidentified substances should not be tested [2,4]. Allergens are removed on day 2, a second reading on day 3 or day 4 is required, and a later reading around day 7 is recommended because late reactions occur [1,4]. Distinguishing a weak allergic reaction from an irritant or doubtful one is a major interpretive challenge, and substantial intra- and inter-observer variation among experts led to a modified International Contact Dermatitis Research Group classification [10,11]. The temporal pattern across readings is often decisive, because allergic reactions persist or increase, whereas irritant reactions fade [4]. When suspicion persists despite negative testing, the repeated open application test assesses the product under conditions closer to actual use, and a negative test after two weeks may need to be extended to three or four weeks [1].

Table 1: Distinguishing features of irritant and allergic contact dermatitis^a.

Feature	Irritant contact dermatitis	Allergic contact dermatitis
Mechanism	Barrier disruption and innate immunity	T cell-mediated delayed hypersensitivity
Susceptible population	Anyone, given sufficient exposure	Sensitized individuals only
Onset	Hours after a potent irritant, gradual with repeated weak irritants	Usually 24 to 48 hours after re-exposure
Margins	Well defined, limited to the contact area	Ill defined, often extending beyond the contact area
Dominant symptom	Burning, stinging, or soreness	Pruritus
Course after exposure	Decrescendo in acute forms	May worsen for some days (crescendo)
Investigation	No confirmatory test, diagnosis of exclusion	Patch testing, including workplace materials

^aFeatures overlap considerably, and no single feature is discriminatory. Adapted from [1,2,9].

A positive reaction is relevant when sufficient exposure can be documented and the dermatitis can reasonably be explained by that exposure [4]. The dose required may be lowered by repeated or combined exposures, damaged skin, occlusion, friction, and sweating [4]. Relevance may be current, past, or unknown, and each diagnosis should state whether work is the sole, the predominant, or a contributory cause, or not a cause at all [4]. When relevance remains unknown, further exposure assessment and, where feasible, a workplace visit should precede the exclusion of an occupational cause, because the visit often provides information that is not obvious to the worker or the employer [4].

Establishing Occupational Causation

Two formal frameworks support the attribution of occupational causation and are best applied as complements (**Table 2**). The seven Mathias criteria address both causation and aggravation of irritant or allergic contact dermatitis, and four or more affirmative answers support a probable occupational origin [2,12]. This threshold has been reported to correspond to a probability of occupational causation of 50% or more, which supports its medicolegal use, although clear answers are not always possible in complex cases [2]. The nine-step operational definition of Ale and Maibach is restricted to allergic contact dermatitis and relies on patch and use testing [13]. We consider its greater evidentiary detail useful when an allergic causal conclusion is likely to be contested, although several of its steps are rarely feasible outside specialized centers.

Two interpretive points matter in practice. First, occupational dermatitis typically improves away from work, but acute irritant dermatitis may take weeks to heal, allergic reactions may worsen for some days after exposure stops, and chronic irritant dermatitis has a poor prognosis for complete healing [3,9]. The absence of improvement after a brief absence from work therefore does not exclude occupational causation. Second, persistent non-occupational exposure does not in itself exclude an occupational contribution, because the relative contributions of occupational and non-occupational exposure must be weighed [4].

Irritant contact dermatitis, although it represents most occupa-

tional cases, requires a different evidentiary route, because no confirmatory test exists. The causal argument rests on a documented irritant exposure of sufficient frequency, intensity, and duration, on the course of the dermatitis in relation to exposure, and on the exclusion of relevant contact allergy [3,9]. Aggravation deserves equal attention. Workers with a history of atopic dermatitis are at increased risk of irritant hand dermatitis [9], the Mathias criteria explicitly address aggravation [12], and in Portugal the notification of suspected occupational disease also covers the aggravation of a pre-existing condition [14]. The diagnostic statement should therefore specify any pre-existing disease and the exogenous co-factors involved, in addition to the causative exposure [4].

These frameworks construct the causal argument, but recognition and compensation in Portugal are determined against the national list of occupational diseases, whose chapter on skin diseases was revised in 2007 [15]. We recommend that the clinical formulation correspond as closely as possible to the nomenclature of that chapter. For a listed disease, compensation requires that the worker has the disease and was exposed to the corresponding risk through the nature of the work. A disease not included in the list may still be compensated when it is shown to be a necessary and direct consequence of the work performed and not normal wear of the organism [16].

Exposure Assessment

Causation assessment requires exposure to be characterized rather than merely asserted [4]. The parameters to be documented include the potency and physicochemical properties of the substance, its concentration, and the duration, frequency, skin site, and area of exposure, together with workplace factors that enhance penetration, such as wet work, occlusion, and mechanical trauma [4,9]. The amount of allergen deposited on the skin can be assessed in practice for only a few allergens, such as nickel with the dimethylglyoxime spot test [4].

Wet work should be quantified against an operational definition rather than described qualitatively. The classic definition, introduced in 1996 by the German Technical Rules for Hazardous Substances (TRGS) 401, comprises regular skin contact with liquids for more than two hours per working day, regular use of

Table 2: Frameworks for establishing occupational causation of contact dermatitis^a.

No.	Mathias criteria (irritant and allergic, causation and aggravation)	Ale and Maibach operational definition (allergic only)
1	Clinical appearance consistent with contact dermatitis	History of occupational exposure
2	Workplace exposure to potential cutaneous irritants or allergens	Temporal relationship between occupational exposure and onset
3	Anatomical distribution consistent with cutaneous exposure related to the job	Morphology consistent with occupational exposure
4	Temporal relationship between exposure and onset consistent with contact dermatitis	Positive diagnostic patch test with appropriate vehicle and concentration
5	Non-occupational exposures excluded as probable causes	Repeat patch test where appropriate, to exclude excited skin syndrome and rogue reactions
6	Improvement of the dermatitis away from work exposure	Serial dilution of the chemical tested
7	Patch or provocation tests identifying a probable causal agent	Controls for non-irritating concentrations and special tests for uncommon allergens
8		Provocative use test or repeated open application test to define clinical relevance
9		Clearing of the dermatitis when the allergen is removed or exposure is substantially reduced

^aFour or more affirmative Mathias criteria support a probable occupational origin. Adapted from [12,13].

occlusive gloves for a comparable duration, or frequent hand washing, which has been quantified as about 20 times per day [3]. The current version of TRGS 401 emphasizes skin contact with water or aqueous liquids and frequent hand washing, alone or alternating with the wearing of liquid-tight gloves, and no longer considers the wearing of liquid-tight gloves alone to be wet work [8]. This change is consistent with systematic evidence that is limited for occlusive glove use without other exposures and moderate when glove use is combined with other wet work [3]. Quantification against a recognized threshold turns a vague description into a documented exposure.

Prevention

Prevention should follow a hierarchy of controls rather than an undifferentiated list of recommendations [6,9]. The German hand eczema guideline applies the STOP principle, which gives priority to substitution or elimination of the causative agent, followed by technical, organizational, and finally personal protective measures [6]. Gloves are therefore the last layer of protection. Their material should be selected according to the specific hazard, the task, and the permeation time [9], and occlusion under gloves may itself impair barrier function [9]. Gloves should be worn when required but not longer than necessary, with cotton undergloves beneath liquid-tight gloves when wearing times exceed about 10 minutes, depending on individual sweating [6]. Skin care products complement but do not replace exposure reduction, and where hygienically acceptable, alcohol-based hand disinfection is preferable to washing with detergents [2,7].

Skin protection education is widely recommended, and work-related programs have been effective in some occupational groups [9]. A Cochrane review, however, rated the evidence for its effect on the primary prevention of occupational irritant hand dermatitis as very low certainty and the evidence for moisturizers as low certainty [17]. Educational measures should therefore support rather than replace higher-level controls. Secondary prevention depends on early detection, because workers often delay seeking care for months, partly for fear of job loss, and a longer delay is associated with a poorer prognosis [2]. For severe occupational hand eczema refractory to outpatient treatment, multidisciplinary tertiary prevention programs combining three weeks of inpatient treatment, a further period without occupational exposure, intensive educa-

tion, and vocational counseling have reduced eczema severity and days of absence from work [6,9].

Treatment and Return to Work

Treatment is based on identification and avoidance of the causative agent and on restoration of the epidermal barrier with regular use of emollients [1,9]. Topical corticosteroids are the first-line anti-inflammatory treatment for allergic contact dermatitis [1] and are commonly used in chronic hand eczema [18], whereas their role in irritant dermatitis is controversial, because prolonged use may impair barrier function [9]. Topical calcineurin inhibitors are a steroid-sparing option, and severe or relapsing disease may require phototherapy or systemic immunosuppressive agents [1]. The topical pan-Janus kinase inhibitor delgocitinib was superior to vehicle in two phase 3 trials in patients with moderate to severe chronic hand eczema [19].

Return to work should be planned as a graded process. The prognosis for complete healing of irritant dermatitis is poor when exposure continues unchanged [3], and a graduated return with ongoing skin monitoring to detect early recurrence has been used successfully [2]. Effective communication between the physician, the worker, the workplace, and the insurer, together with clear written recommendations, supports successful return to work [2]. The occupational physician should translate the diagnosis into specific exposures to be avoided and tasks to be modified rather than describe it only in clinical terms. Skin-specific workplace prescriptions that combine work restrictions, choice of protective equipment, hand hygiene, and treatment advice have been developed for this purpose [2].

In Portugal, these restrictions acquire operational force through the fitness-for-work form that the occupational physician completes after each health examination [20,21]. The form classifies the worker as fit, conditionally fit, temporarily unfit, or permanently unfit. It must be signed by the worker, and a copy is sent to the employer [20,21]. It cannot contain information covered by medical confidentiality [20], which provides a legal as well as a practical reason to word restrictions as exposures to be avoided rather than as a diagnosis. We recommend conditional fitness with a defined review date as the usual outcome, with unfitness reserved for cases in which exposure cannot be

Table 3: Stepwise pathway from clinical suspicion to notification of occupational contact dermatitis in Portugal^a.

Step	Task of the occupational physician	Key tools and instruments
1. Clinical suspicion	Recognize dermatitis at exposed sites and take a structured occupational and non-occupational exposure history	Occupational history, safety data sheets
2. Diagnosis	Refer for patch testing with baseline and occupation-specific series and workplace materials	European patch testing guideline
3. Relevance and causation	Establish clinical relevance, apply the Mathias criteria, use the Ale and Maibach definition in contested allergic cases, document any aggravation	Mathias criteria, Ale and Maibach definition
4. Exposure assessment	Quantify exposure, including wet work, and consider a workplace visit	Wet work definitions, TRGS 401
5. Prevention	Apply the hierarchy of controls, select gloves by hazard, task, and permeation time, implement skin care and education	Hand eczema and occupational skin product guidelines
6. Fitness for work	Issue the fitness-for-work form with restrictions worded as exposures to be avoided, plan a graded return, set a review date	Law No. 102/2009, Ordinance No. 71/2015
7. Notification	Notify on reasonable suspicion of occupational disease or aggravation, with the diagnostic evidence	Mandatory notification form, Department of Protection against Occupational Risks

^aTRGS: Technical Rules for Hazardous Substances. Authors' synthesis of the sources cited in the text.

adequately controlled, because unfitness may cost the worker the job without resolving the dermatitis if the same exposure recurs in the next post. Persistent disease despite optimized controls may nevertheless justify redeployment, because a systematic review found moderate evidence that the prognosis of irritant contact dermatitis improves after a change of work tasks or occupation [3]. A history of atopic dermatitis should be recorded at the pre-placement examination so that skin protection and surveillance can be intensified from the outset [6], but in our view it should not in itself justify exclusion from employment.

Notification

In Portugal, any physician who suspects an occupational disease or its aggravation, including general practitioners and hospital specialists, is legally required to notify it [14,22]. The physician's notification form is sent together with the complementary diagnostic examinations, including patch test results, to the Department of Protection against Occupational Risks of the Social Security Institute, which assesses and certifies the occupational disease [14]. The formal determination of occupational causation is therefore made by this administrative body, not by the notifying physician. Because the duty is triggered by reasonable suspicion rather than by diagnostic or legal certainty, diagnostic uncertainty should not delay notification. The complete sequence, from clinical suspicion to notification, is summarized in **Table 3**.

Discussion

The central argument of this review is that each step after the dermatological diagnosis, from relevance and causation to exposure quantification, prevention, fitness for work, and notification, has its own evidentiary standard and legal instrument, and none follows automatically from a positive patch test.

This mini review has limitations. It is a narrative rather than a systematic review, the selection of sources was not protocol-based, and the synthesis reflects the interpretive judgment of the authors. The Mathias criteria provide a probabilistic rather than a definitive attribution [2], and the Ale and Maibach definition applies only to allergic disease. Because repeated low-dose exposure, damaged skin, friction, and sweating lower the dose needed to elicit dermatitis [4], a single patch test application to intact skin may not reflect workplace exposure, so a negative result should be interpreted with caution when occupational suspicion remains high. The evidence for barrier creams, moisturizers, and skin protection education in primary prevention is of low or very low certainty [17]. The medicolegal sections describe the Portuguese framework, and notification procedures and recognition criteria differ between countries.

Conclusion

Occupational contact dermatitis is the most common occupational skin disease and frequently reflects overlapping irritant and allergic mechanisms. Its diagnosis requires a detailed occupational history and patch testing with an occupation-appropriate series supplemented by the materials handled at work. The distinctive task of occupational medicine is to translate that diagnosis into a documented causation assessment, a quantified exposure assessment, a hierarchy of preventive measures, a fitness-for-work decision worded as exposures to be avoided with a graded return to work, and statutory notification whenever occupational disease is reasonably suspected. These steps

turn a dermatological diagnosis into an occupational health decision.

Author Contributions:

Mafalda Bica Tavares and Martim Luz contributed to the concept and design, acquired, analyzed, and interpreted the data, and drafted the manuscript. João Coutinho de Sousa, Renato Matos, Amanda Dias, Beatriz Oliveira, Miguel Magalhães, Catarina Carvoeiro and Filipe Araújo contributed to the concept and design. Martim Luz critically reviewed the manuscript for important intellectual content. Nuno Augusto Saldanha and Sara Alves Matos supervised the work and critically reviewed the manuscript for important intellectual content. All authors approved the final version of the manuscript and agreed to be accountable for all aspects of the work. Mafalda Bica Tavares is the guarantor of the work.

Competing Interests: The authors declare that they have no competing interests.

Grant Information: The authors received no specific funding for this work.

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