Abstract

Occupational dermatoses (OD) have topped the list of occupational diseases in Germany for years. Presently, approximately 16,000 new OD cases are officially reported to public statutory employers’ liability insurance bodies, each year. The disease burden is high not only for individuals but also for society as a whole. Estimated annual economic costs in Germany due to sick-leave and lack of productivity due to OD are more than 1.5 billion euros. Thus, in recent years, various pilot initiatives aiming to improve prevention of occupational skin diseases (of various degrees of severity) have been developed and recently evaluated in Osnabrück. These activities have been funded by statutory employers’ liability insurance schemes. Concepts underpinning these initiatives include multidisciplinary skin protection teaching programs for various high-risk professions, which turned out to be pivotal for the success of these projects. A corollary of this work is a nationwide multi-step intervention approach currently implemented by the public statutory insurance system. This approach offers quick preventive help for all levels of severity of OD. These nationwide activities are accompanied by a national Prevention Campaign: Skin 2007/2008 (Figure 1), which focuses mainly on primary prevention.

Despite the high prevalence of OD and its poor prognosis, little is known about the molecular mechanisms underlying individual susceptibility to develop chronic irritant dermatitis. Skin irritation tests are thus far of only limited value. Presently, our institution, in collaboration with Amsterdam universities, focuses on immunogenetic risk factors potentially involved in individual susceptibility to OD in order to improve pre-employment counseling and predictive skin testing.

For early secondary prevention, the so-called dermatologist’s procedure was recently updated in order to provide more rapid dermatological consultation. Additionally, combined outpatient dermatological and educational intervention seminars (secondary individual prevention, SIP) are offered to affected employees. We recently demonstrated the sustainability of the SIP approach in hairdressing for periods of up to 10 years.

For those cases of OD, in which the abovementioned outpatient prevention measures are not sufficiently successful, specific interdisciplinary inpatient prevention measures have been developed (tertiary individual prevention, or TIP). TIP represents the ultima ratio within the hierarchical prevention concept of the Osnabrück Model. TIP comprises 2–3 weeks of inpatient dermatological diagnostics and treatment as well as intensive health-related pedagogic and psychological counseling. Subsequent to this, 3 consecutive weeks of outpatient treatment are given by a local dermatologist. Each patient remains on sick-leave for a total of 6 weeks to allow full barrier recovery. A total of 764 out of 1164 (66%) TIP patients treated in our university, followed-up regularly by a local dermatologist for up to 1 year, were successful in remaining in their respective (risk-) professions as assessed by questionnaire 1 year after discharge.
Recently obtained SIP and TIP data reveal that there are reliable, evidence-based options for multidisciplinary prevention and patient management of OD, using a combined approach by a network of clinics, practices and statutory social insurance bodies. A multicentre study, which aims to further standardize TIP and evaluate sustainability of prevention in more depth (3-year dermatological follow-up of 1000 OD patients) is currently being conducted in Germany.

Zusammenfassung

Hautkrankheiten sind die häufigsten berufsbedingten Erkrankungen, die in bis zu einem Viertel der gemeldeten Verdachtsfälle zu Arbeitsplatzverlust führen. Die volkswirtschaftlichen Folgekosten durch Produktivitätsausfall liegen bei >1,5 Milliarden € jährlich. In Osnabrück werden seit über 10 Jahren Präventionsmodelle auf allen Ebenen der berufs-dermatologischen Prävention interdisziplinär entwickelt, die in einigen Risikoberufen bereits zu einer erheblichen Senkung der Verdachtsmeldungen, aber auch der Kosten für die Unfallversicherungsträger (UVT) beitragen konnten.

Im Bereich der primären Prävention sind qualifizierte Berufseingangsberatungen bei Risikoberufen wünschenswert; eine verbesserte Prädiktion der individuellen Hautempfindlichkeit kann hier hilfreich sein, im übrigen auch für präventive Untersuchungen im Rahmen der Gefahrstoffverordnung. Hier gibt es neuere Entwicklungen, die auch die Objektivierbarkeit einer verbliebenen kutanen Minderbelastbarkeit nach früherem Berufseknz betreffen. Ein besseres Verständnis des komplexen molekular-genetischen Hintergrundes der chronischen Kontaktdermatitis wird zur Entwicklung gezielterer Präventionsstrategien sowie präziserer diagnostischer und therapeutischer Verfahren beitragen.

Im Bereich der Sekundärprävention ergab unsere Pilotstudie zum Hautarztverfahren im Norddeutschen Raum, die zugleich eine erste systematische Maßnahme zur Qualitätssicherung darstellte, eine signifikante Verbesserung des Informationsflusses durch eine auf aktuellen Erkenntnissen basierende Neukonzeption der Hautarztberichte. Mittlerweile wurde dies neue Hautarztverfahren in beispielhaft kurzer Zeit bundesweit eingeführt.

Ergänzend zum Hautarztverfahren wurden hier ambulante interdisziplinäre Beratungsangebote (dermatologisch/educativ) konzipiert und evaluiert („Sekundäre Individualprävention“ [SIP]), die mittlerweile bundesweit angeboten werden. Die Konsequenz, mit der die Studienergebnisse umgesetzt wurden, signalisiert einen Paradigmenwechsel bei der gesetzlichen Unfallversicherung im Bezug auf eine möglichst zeitnahe und effiziente Prävention.

Hierzu gehört auch, dass in den letzten Jahren die tertiäre Individualprävention (TIP) nach dem Osnabrücker Modell für Menschen mit
schweren Berufsdermatosen und dem Ziel des Arbeitsplatzerhaltes zunehmend an Bedeutung gewinnt; unsere aktuellen Daten zeigen, dass 66% der schwer Erkrankten, die in der Vergangenheit nahezu ausnahmslos den Arbeitsplatz verloren hätten, durch die Maßnahme im Beruf verbleiben konnten. Die Weiterentwicklung dieses interdisziplinären und stationär-ambulant vernetzten Heilverfahrens wird jetzt im Rahmen einer bundesweiten Multicenterstudie vorangetrieben.

Die Berufsgenossenschaft für Gesundheitsdienst und Wohlfahrtspflege (BGW) hat von allen UVT den höchsten Anteil Versicherter mit Berufsdermatosen. Bei der BGW sind die Kosten für berufliche Rehabilitationsmaßnahmen bei Hauterkrankungen in den letzten 12 Jahren mit zunehmender Umsetzung der genannten Präventionsmaßnahmen um >60% gesunken: von 35,5 auf 13,3 Mio. € p.a. In gleichem Umfang ist die Häufigkeit berufbedingter Hauterkrankungen bei BGW-Versicherten zurückgegangen. Parallel sind die Beiträge der Arbeitgeber für die gesetzliche Unfallversicherung z.B. in Risikoberufen wie dem Friseurgewerbe um über 60% gesunken; hier ist der sozialpolitisch sensible Bereich der Lohnnebenkosten unmittelbar betroffen. Das sozio-ökonomische Potenzial von Prävention wird hier deutlich: Verbesserungen der Leistungen für den Einzelnen und Maßnahmen zum Erhalt der Gesundheit und des Arbeitsplatzes sind bei gleichzeitiger Senkung von Kosten für die Solidargemeinschaft erreichbar.

Dies ist auch ein Grund, warum die gesetzliche Unfall- und Krankenversicherung sowie die Bundesländer die „Präventionskampagne Haut 2007–2008“ ins Leben gerufen haben, die eine bewussteren Umgang mit dem größten Organ des Menschen wirbt. Es handelt sich um das erste trägerübergreifende präventivmedizinische Großprojekt in der deutschen Sozialversicherung. Diese Initiative unterstreicht, welches Potenzial man Präventionsmaßnahmen bei Hautkrankheiten und Allergien für die Gesundheitsförderung in Deutschland aktuell bei- misst. Die Kampagne wird durch die Osnabrücker Arbeitsgruppe wissenschaftlich begleitet.

Die deutsche Version des Artikels ist verfügbar unter http://www.egms.de/en/gms/2008-6/000051.shtml.

1. Conditions framing preventive medical research in Osnabrück

The following discussion is preceded by a historic and a recent quotation:

“Since both in importance as well as in time, health precedes disease, we ought to consider first how health is preserved, and then how one may best cure disease.”
Claudius Galeninus 129–199 AD

“Our health system, which is thus far predominantly based on cure, rehabilitation, and nursing, guarantees quality health care for all citizens. By strengthening prevention measures with a prevention law, this system will undergo necessary expansion. It will then further develop to serve as a modern health system, in which prevention, cure, rehabilitation, and nursing are all on a par.”

Official draft of the Federal Ministry of Health [and Social Security] (BMGS) for a prevention law (Stand as of December 2004, c.f. Appendix 2, German Federation of the Statutory Accident Insurance Institutions (HVBG) Newsletter, Prevention-BG 070/2004, 20.12.2004, p. 3.)

Both quotations, which are separated by almost two millennia, have similar messages and may well serve as mottoes for the Osnabrück research team; for more than 10 years the prevention and rehabilitation of skin diseases and environmental allergies has been being researched here. Researchers have succeeded in forming a team, which unites dermatologists, occupational health practitioners, educators, psychologists and other researchers in a dynamic interdisciplinary collaboration. Although medicine has been widely revered as omnipotent in modern times, it has increasingly had to face its own limitations. This also presents an opportunity: If medicine once again recognizes health protection/prevention as a fundamental part of the discipline, it can in turn regain trust and become an inherent part of general education, once more [62]. Scientifically documented successes have elevated preventive medicine into the center stage of political decision-making. The intention of the German coalition government to strengthen prevention measures in order to serve as an “individual mainstay of health care” [4] is a result of these recent findings.
This encourages us all the more to continue performing prevention research as practiced here, which contributes to quality assurance of prevention measures in terms of evidence-based prevention. The evaluation of various interdisciplinary prevention concepts is being attempted using the example of occupational dermatology in a series of staged research projects by teams and individuals. Activities are also guided by efforts to implement these new findings in medical training and post-graduate education [8], [32], [33], [34], [36], [39]. It is our aim to create an integrated system of prevention services that interlock and build upon on each other for the benefit of people in high-risk occupational environments.

Recently, a breakthrough was made with a new conception of the dermatologist’s procedure, i.e., the “improved dermatological procedure”. Based on the findings of an Osnabrück pilot study in the region of northern Germany, this procedure was introduced nationwide [10], [35]. Analogously, inpatient management developed according to the so-called Osnabrück Model for people with serious occupational skin diseases and allergies are presently being further improved in a nationwide multicentre study [37], [43].

It may be asked, how the study of prevention in chronic diseases – specifically the example of occupational skin diseases – could thrive so well in a university without a faculty of medicine? One answer is that it is precisely because of this fact that the preventive approach was never in danger of playing second fiddle within the context of predominantly curative medicine. Indeed, the realization of research projects could be achieved by a constructive collaboration of various disciplines. Accordingly, this paper should also be understood as a plea for prevention research as a concerted effort of the most diverse institutions, which, in this case, encompasses medical (dermatology, occupational medicine) as well as educational (pedagogy, psychology, ergotherapy) and legal (social law) disciplines. The existing social legislation provides an authoritative legal background against which prevention and health promotion can take place in Germany. Moreover, the long-anticipated comprehensive prevention law for all insurance carriers, which is stipulated in the current coalition agreement of the German government, is also timely.

To some extent, the Prevention Campaign: Skin (Präventionskampagne Haut) was launched January 11, 2007, in anticipation of a prevention law and as a combined initiative of public statutory accident and health insurance schemes. At the same time, this further emphasizes the importance of the topic of skin diseases and the potential inherent in prevention existing in this area. Moreover, it is the first case of a major preventative medical project involving all carriers in German social insurance. The campaign receives scientific advice from the Osnabrück research team. Importantly, networking – as practiced in the fields of dermatology, environmental medicine, and theory of health in Osnabrück – does not only concern the inner academic circles of university as such. It also includes numerous non-university institutions such as social insurance carriers, medical practices, and hospitals. In this manner, models for interlocking outpatient and inpatient care (referred to as: integrated care) with the objective of optimizing cooperation between diverse health care providers with regard to prevention, were developed and successfully implemented [43], [45].

By way of example, data of the Professional Association for Health Services and Welfare, Hamburg (Berufsgenossenschaft für Gesundheitsdienst und Wohlfahrtspflege, BGW) illustrate the development of costs for occupational skin diseases during the past 12 years (Figure 2). Germany’s BGW is the public accident insurer with the most cases of skin disease among its insured clients. The figure shows the effects of specific, science-based prevention measures as tested in collaborations between the BGW and the University of Osnabrück in various model projects. The concepts developed and evaluated as a result are essentially based upon a combination of medical consulting and services and of health education to influence the behavior of affected persons, which is occupation-specific and adapted to individual requirements [55], [72], [83], [85]. These concepts have proven so successful that they have been implemented in the meantime by the BGW and other accident insurers in the form of multidisciplinary outpatient consulting centers and integrated into standard benefits. The BGW’s expenditures for occupational rehabilitation measures related to skin diseases were reduced by more than 60% within the period under review since the introduction of these measures. At the same time, the frequency of occupational skin diseases among insurants of the BGW decreased to the same extent. This demonstrates the socioeconomic potential of prevention: improvements of benefits for individuals as well as measures for health maintenance and continuation of employment can be realized while reducing the costs for the collective body of the insured (Figure 2).

1.1 Successful prevention: the example of occupational skin diseases

Chronic occupational contact dermatitis (of irritative, allergic, or mixed genesis) is an inflammatory skin disease of increasing prevalence. In industrial nations in particular, its socioeconomic and psychosocial relevance is significant. In Germany, skin disorders continue to be by far the most common occupational diseases. As they are persistent and incapacitate individuals to work for lengthy periods, the economic follow-up costs due to nonworking time (sick-leave) and diminishing productivity in business are considerable. These costs are estimated at more than 1.5 billion euros per annum [5].

Through concerted prevention measures, the frequency of occupational diseases was successfully reduced in certain focal areas over the past years. During the past decade, for example, insurers experienced a decline in the number of reported suspected cases of occupational disease in hairdressing (60%) [22], [46], as well as a reduction of occupational skin and respiratory diseases...
caused by latex in health care (>80%), during the same period [1], [2], [3]. While these effects are related to the impetus generated by the Osnabrück Model they also demonstrate the remarkable effectiveness of specific, multidisciplinary prevention measures. The statutory occupational accident insurance system recognized these results [29], which, in recent years have enabled us to initiate – in cooperation with the Study Group for Occupational and Environmental Dermatology (Arbeitsgemeinschaft für Berufs- und Umweltdermatologie, ABD) within the German Dermatological Society (Deutsche Dermatologische Gesellschaft, DDG) – a whole package of measures to significantly improve prevention of occupational skin diseases on behalf of employees in high-risk occupations. The following discussion gives an account of these initiatives.

2. Primary prevention

Primary prevention represents a focus of applied occupational health education [70], [85]. The function of primary prevention is to avert occupational dermatoses (OD) by means of providing information and training for skin-protective behavior (referred to as: behavioral prevention), of ensuring skin-protective working environments in accordance with the respective regulations (cf. environmental prevention, in: Technical Rules for Hazardous Substances, German Hazardous Materials Ordinance/Technische Regeln Gefahrstoffe, Gefahrstoffverordnung) as well as of offering consultation regarding individual skin sensitivity.

The question, however, as to what constitutes increased individual skin sensitivity and how it can be reliably diagnosed, remains unsolved. This question becomes even more important with Germany’s current Hazardous Materials Ordinance (Gefahrstoffverordnung), effective January 1, 2005. For the first time, the ordinance stipulates compulsory occupational health examinations for employees who perform wet work for at least 4 hours per day. Wet work represents the most decisive factor in the genesis of OD; wearing protective gloves that are occlusive also qualifies as wet work in this context. Therefore, it can be assumed that several million German employees meet the conditions stipulated in the Hazardous Materials Ordinance and should therefore take part in such occupational health examination and consultation in future, subject to law [54]. As of yet, it has not been decided, how and on the basis of which criteria the examinations shall be conducted.

The identification of persons with sensitive skin is also particularly urgent; studies consistently show that their share within the general population as well as among people in humid working environments is increasing [16], [22]. The high number of atopics is particularly noteworthy in this respect. More than half of patients with OD fall in the category of persons with a predisposition to highly sensitive skin and mucosa as well as with a tendency to develop atopic diseases (e.g., atopic dermatitis, hay fever or pollinosis, allergic asthma). In these cases, a focused pre-employment consultation concerning up-to-date methods of skin protection to be used from the first day of exposure to wet work would be part of essential primary prevention.
Another important aspect, especially for atopics, is the influence exerted by common waterproof protective gloves on skin irritation due to occlusion effects. In Osnabrück, we have been collecting information on positive experiences with protective gloves made from various semipermeable membranes, for some time. On the one hand, they minimize the accumulation of humidity and the subsequent measurable barrier impairment caused by occlusion (transepidermal water loss, TEWL) [82], and on the other hand, they foster barrier regeneration of damaged skin to a remarkable extent [11]. These gloves have gained a high degree of user acceptance, however, the lack of resistance to chemicals remains problematic.

2.1 Individual skin sensitivity: from prediction to prevention

2.1.1 Definition and diagnostics

The term “sensitive skin” has not been precisely defined in dermatology. Nevertheless, it is commonly used and is most frequently understood as increased skin reactivity to irritative noxa. However, objectifying suspected cases of increased skin sensitivity remains problematic. In general, various skin provocation tests using irritants are applied, but a universally accepted “gold standard” is still lacking.

It is now scientifically proven that cutaneous responsiveness to irritants in some patients is significantly more pronounced than that in the majority of human subjects. The main reason for this is probably a genetic disposition, which is not necessarily related to atopy [24], [25], [26]. According to recent findings, there are very different, individual reaction patterns to irritant stimuli that range on a broad spectrum between the extremes of tolerance and hyperirritability. High cutaneous tolerance to irritants as well as hyperirritability, seem to occur primarily and secondarily (developed after prolonged exposure). For example, the adaptation phenomena observed in hairdressing that results in the development of tolerance post-exposure, is termed hardening [84]. Uter described cases of apprentice hairdressers who developed hand eczema early in their careers, which healed later in professional life and ultimately led to remarkable resilience. This effect, in some cases, occurred even in the absence of skin protection [76]. The mechanisms that bring about hardening are as yet unknown. Unfortunately, this phenomenon can only be observed in a minority of exposed persons in high-risk occupations.

Daily occupational dermatological practice shows that the opposite phenomenon also exists. That is, even after the healing of severe hand eczema due to intense exposure to humidity, affected persons maintain to exhibit increased skin sensitivity when exposed to everyday stresses. Potential pathogenetic mechanisms of this – normally subclinical – secondary hyperirritability are unknown. This is also related to the fact that a generally accepted verification procedure for (primary and secondary) cutaneous hyperirritability is still missing. Discussions are controversial as to whether current procedures can shed light on constitutional characteristics or whether they only provide a picture of skin reactivity at a given moment in time [24].

Although a diagnostic gold standard is lacking, occupational dermatologists are frequently expected to specify the extent of an individual’s skin sensitivity. This applies not only to pre-employment consultation (and examinations based on the Hazardous Materials Ordinance). Among other things, the dermatological expert has to quantify subsequently reduced skin endurance for the assessment of the reduction in the ability to work. Medico-legal evaluations such as these have far-reaching consequences for affected persons, not least of which are decisions concerning pension payments drawn on them. While allergological diagnostics is established and national as well as international professional societies have developed authoritative standards for the implementation and interpretation of related tests [7], [59], [78], this is not the case for skin irritability diagnostics. Nevertheless, there are concrete efforts to standardize the routine use of sodium hydroxide (NaOH) and sodium lauryl sulfate (SLS) as model irritants, of which NaOH shall be discussed in the following. In order to assess the changes in the barrier function of skin caused by the tests, modern biophysical measuring methods are employed [49].

2.1.2 NaOH provocation tests (alkali-resistance tests)

The most common functional test in occupational dermatology in the German-speaking area is the alkali-resistance test according to Burckhardt 1947 [15]. The test, during which diluted NaOH solution is applied on the skin under occlusion, has been modified by Burckhardt and his co-workers repeatedly [13], [14], [56]. Most of the modifications concerned test duration, concentration of the solution, and recording test results. Today, challenge with 0.5 M NaOH for three 10-minute periods under supervised clinical observation is implemented most frequently. We were able to demonstrate, however, that a wide variety of modifications to the NaOH test are performed by practicing occupational dermatologists, mostly with reference to Burckhardt [49]. The lack of standardized procedures may be one of the reasons why the relevance of this test is considered very differently by occupational dermatologists [38], [49].

In general, challenge with NaOH aims at determining individual sensitivity of the skin barrier to alkaline substances, to which we are frequently exposed in private and professional life. NaOH also seems especially suitable as a model irritant in occupational dermatology because wet work is one of the main causes of irritative dermatoses. Typically, wet work is defined as a minimum of 2 hours of regular daily contact with (aqueous) liquids or of wearing humidity-impermeable gloves (cf. Technical Regulation for Hazardous Materials (Technische Regeln für Gefahrstoffe, TRGS) 401 of June 2008 and the valid Hazardous Materials Ordinance of January 2005). Simply
Figure 3: Test procedure for the swift modified alkali resistance test (SMART) as presently practiced by the “Task force on Assessment and Evaluation of Irritant Skin Damages” of the ABD

Test site: medial forearm, ventral. The same procedure is performed for the differential irritation test (DIT), when the SMART is carried out in parallel on the back of the hand corresponding to chirality and the contralateral forearm. TEWL = transepidermal water loss. Clinical and biophysical readings are to be conducted 10 min after the second provocation phase.

by the diluting effect of humidity on the skin, wet work causes an increase in the pH of physiologically acidic skin (approx. pH 5.5) after depletion of its buffer systems, hence resulting in alkalization. Thus, wet work-induced alkalization of the skin surface is simulated by NaOH challenge. Recent studies increasingly demonstrate the importance of an acidic skin pH for homeostasis of the skin barrier. An acidic milieu is particularly essential for the complex architecture of epidermal lipid layers, which are instrumental for the functional integrity of the stratum corneum [27].

In Osnabrück, we have made use of these findings to develop new therapies. As we were able to show, rinsing with CO₂-impregnated water favorably influences the healing of eczema and has a protective effect for eczema in the case of experimentally induced irritation [12].

2.1.3 Current NaOH provocation tests in occupational dermatology

2.1.3.1 Swift modified alkali resistance test (SMART)

Burckhardt’s alkali resistance test results in superficial necrosis in 1% of cases (colliquativenecrosis) [75]. Naturally, this refers to persons with sensitive skin in particular, as they are overrepresented in collectives treated by occupational dermatologists.

Therefore, a less invasive swift modified alkali resistance test (SMART) was developed in Osnabrück. It employs up-to-date biophysical diagnostics (measurement of TEWL) and 0.5 M NaOH exposure for only two 10-minute periods as well as a drying and observation interval between sessions. The test was clinically evaluated in 572 persons with a history of examination by occupational dermatologists, and standardized (test site: forearm) [49] (Figure 3). Challenge with 0.9% sodium chloride (NaCl) served as a control. The test allowed identification of genotypic characteristics (atopic skin disposition) in the studied cohort, both clinically and biophysically. Thus, SMART appears to be helpful in identifying increased constitutional risks within the context of occupational dermatologic issues, while reducing invasiveness and time expenditure and improving validity as compared to conventional procedures [38], [48].

2.1.3.2 Differential irritation test (DIT)

Subsequently, SMART was applied in a trial to assess secondary irritant skin changes (secondary hyperirritability). For purpose of comparison, the test was carried out synchronously on two parts of the body. One part was continuously exposed to occupation-related irritants of the subject’s past (back of the hand), while the other part was not (ventral forearm). On the basis of a pilot study involving a control group (31 subjects) and a group with healed occupational eczema (48 subjects), a differential irritation test (DIT) was developed [24], [44], [49].

Normally, the skin on the back of the hand is very robust. Normal persons shown no reactivity to the SMART in this area. However, a subcohort of approximately 10% of studied patients, which previously suffered from occupational hand eczema (healed at time of testing), exhibited *prima facie*, a seemingly paradoxical phenomenon: skin reactions on the back of the hand were stronger than those on the forearm. A reversal in the normal hierarchy of skin reactivity was observed in this subcohort in a skin area which was previously exposed to occupational skin hazards and affected by eczema. This result points to secondary hyperirritability in terms of acquired reduced skin endurance. In persons with normal skin, such a paradoxical pattern of findings is not encountered. In the meantime, the phenomenon of an inverse hierarchy of skin sensitivity, expressed in acquired hypersensitivity of the back of the hand, was confirmed in another sample.

In this study, the phenomenon was observed in 49 of 554 former wet workers with healed eczema [38], [44].
Thus, there is evidence that the proposed test is of socio-
medical relevance (i.e., extent of the reduction in earning
capacity [9]; prognostic outcome, for example, concerning
the prospects of success of preventive measures). Thus
far, DIT is the first methodological approach to objectify
subclinically reduced endurance of the skin of the hands
following an earlier case of occupational eczema (healed
at time of testing).

2.1.4 Standardization of irritability diagnostics
in occupational dermatology
In light of the incidence and relevance of irritant skin
damages, it is unfortunate that the standardization of
skin irritability diagnostics in occupational dermatology
remains incomplete. Therefore, the Study Group for Oc-
cupational and Environmental Dermatology (ABD) in the
German Dermatological Society (DDG) set up a task force
in 2001 under the name “Assessment and Evaluation of
Irritant Skin Damages”, with the following members: Dr.
G. Bartel, Aachen; Dr. A. Degenhardt, Bremen; PD Dr. R.
Breher, Münster; Prof. Dr. M. Fartasch, Bochum, Prof.
Dr. P. J. Frosch, Dortmund; Prof Dr. S. M. John (Chair),
Osnabrück; Dr. M. Haufs, Bochum; Dr. P. Kleesz,
Mannheim; PD Dr. V. Mahler, Erlangen; Dr. H.-G. Mane-
gold, Bielefeld; Dr. I. Schindera, Völklingen; Dr. N. Siz-
mann, Nürnberg; Dr. K.-H. Tiedemann, Schwäbisch-
Gmünd; Dr. E. Wagner, Berlin; PD Dr. E. Weisshaar,
Heidelberg; Prof. Dr. M. Worm, Berlin. This task force aims
to establish a consensus for occupational dermatologic
diagnostics based on existing scientific findings. At
present, a multicentre study on the SMART/DIT is being
conducted. Moreover, a black list of test procedures that
are proven unsuitable for routine occupational dermato-
logic examinations has been compiled, in order to avoid
unnecessary stress for patients examined [31].

2.1.4.1 Outlook: specific prevention using immunologic
or immunogenetic prediction
The causes of individual skin sensitivity and correspond-
ing risk of contracting irritant contact dermatitis due to
exposure during wet work are incompletely understood.
However, an imbalance of pro- and anti-inflammatory cy-
tokines seems to play a decisive role in this respect. In
addition, several studies suggest the importance of oxid-
ative stress due to reactive oxygen species (ROS) resulting
from external influences on the skin as well as the import-
ance of structural proteins, e.g., filaggrin, for epidermal
barrier function [20], [30], [57], [74]. The coding genes
relevant for the production of inflammation mediators
and filaggrin have proven to be polymorphic. Test proce-
dures developed only recently allow for exploring the im-
munological properties of the stratum corneum barrier
by means of tape-stripping [17], [58]. A number of clues
suggest that the identification of immunological messen-
gers in the uppermost cell layers will permit a causal ex-
planation of the phenomena observed in relation to skin
irritation tests, and thus mark a departure from the
sphere of mere empiricism. Should this prove correct, it
would then be possible in future to dispense with skin ir-
ritation tests such as the alkali resistance test, and to
directly derive predictive conclusions from the observed
patterns of immunological messengers or immunogenetic
findings [50]. Persons with sensitive skin could be advised
at an early stage and subjected to appropriate prevention
measures. An immunogenetic method for identifying indi-
vidual risk factors in chronic occupational eczema is
presently under development at Osnabrück in a joint
project with the University of Amsterdam [18], [19], [20].
Needless to say, serious problems regarding provisions
for protection of privacy will accompany such options for
specific prevention measures employing more and more
precise immunogenetic prediction methods. This issue
remains to be solved. However, this is a general problem
that future prevention efforts in dispositional diseases
will be confronted with, in light of increasing technological
advances in genome research [61].

3. Secondary prevention
Secondary prevention measures are indicated when oc-
cupational skin reactions already exist. Secondary preven-
tion requires accurate medical diagnostics, psychological
understanding, and an improvement of working conditions
[65], [81]. In collaboration with the University of Osna-
brück, the BGW introduced effective early-stage measures
in the form of outpatient skin protection seminars for
patients in the initial stages of disease development (so-
called secondary individual prevention=SIP seminars). These
measures were conceived as complementary to
outpatient treatment in dermatological practices. In the
meantime, other accident insurers have adopted these
concepts, or developed analogous models. It became
consistently apparent that such low threshold prevention
measures are essential for successful secondary preven-
tion of OD [6], [36], [42], [55], [63], [69], [79], [80].
The question of how accident insurers are informed that
an insured employee has developed an occupational skin
disease is of central importance. To this end, the so-called
dermatologist’s report (Hautarztbericht) was introduced
in most federal states in 1972 (as of 1996 for all states).
Thus, the dermatologist’s report and the dermatologist’s
procedure, instituted subsequently as required, occupy
a prominent position in the field of OD-prevention [36],
[47], [51]. Drawing on the results of a pilot study conduct-
ed by the University of Osnabrück in the Northern German
region, the dermatologist’s procedure was recently com-
pletely revised and up-dated on the basis of current
findings in prevention research [35], [47]. This study was
supported by the German Federation of the Statutory
Accident Insurance Institutions (Hauptverband der gewerb-
lichen Berufsgenossenschaften, HVBG). It was realized
in collaboration with the Federation of the Statutory Acci-
dent Insurance Institutions in Northwestern Germany
(Landesverband Nordwestdeutschland der gewerblichen
Berufsgenossenschaften), the Statutory Accident Insur-
The guidelines were recently incorporated in the regulations for quality assurance as well as in guidelines of the DDG [40], [41]. As a rule, treatment should immediately be assigned to the dermatologist, in order to render prompt and optimal care possible for persons with occupational dermatoses. A duly completed dermatologist’s report (form “initiation of prevention”, F6050), which facilitates rapid administrative decisions is a precondition for the assignment of treatment. Company medical officers should be involved in the procedure from the outset, if possible. During outpatient treatment, a progress report (F6052) should normally be made bimonthly. If applicable, this should be complemented by further reports by the concerned company medical officer.

In an unprecedented shortness of time, results of the Osnabrück pilot study were implemented by accident insurers, so that the “improved dermatologist’s report” could be introduced nationwide as early as January 1st, 2006 [10], [42]. The improved dermatologist’s report emphasizes, among other things, an accurate assessment of harmful impacts and, in particular, a definitive statement regarding required preventive (therapeutic and skin protection) measures. For the purposes of optimal early intervention, rapid medical treatment following completion of the report and documentation of progress at close intervals are now required as a rule. In October 2006, guidelines for implementing the dermatologist’s procedure were formulated by the Study Group for Occupational and Environmental Dermatology (ABD), for the first time [42]. These guidelines were recently added to existing guidelines and recommendations of the German Dermatological Society (DDG) [40], [41] (Figure 4). As a consequence, the dermatologist’s procedure has clearly developed beyond the scope of its originally described objectives; today it encompasses the complete spectrum of occupational dermatologic interventions, including continuous dermatological monitoring and therapy for OD-patients. Hopefully, this will contribute to a further increase in the use of the dermatologist’s procedure as a central instrument in the prevention of OD [21], [36], [51].

In parallel with the newly developed dermatologist’s procedure, insurance administrations have introduced the so-called multi-step approach to skin conditions (Stufenverfahren Haut) [23], which complements the prevention concept underlying the improved dermatologist’s report. Experiences of the Osnabrück research team were further incorporated, once again. In future, multi-step prevention measures shall be initiated by the insurance administrations in a more systematic manner and earlier than previously done. In doing so, rapid enforcement of an insured person’s legal claim to prevention measures for purposes of preserving employment shall be guaranteed. Within this concept, the improved dermatologist’s report is of central importance, because it facilitates a rapid decision based on the operational criteria given in the report. Obviously, for this purpose, the report forms have to be duly completed by the submitting dermatologists [10].
The efficiency of the newly conceived prevention measures will be put to test by the Prevention Campaign: Skin 2007/2008 (slogan: “The 2 most important square meters of your life”), during which an increase in reports submitted is expected. Success of the Prevention Campaign: Skin will be evidenced if affected persons are convinced to draw on the legal prevention benefits to which they are entitled, at significantly earlier stages of disease. In this respect, estimates of the significant number of unreported cases of occupational skin disease excluded from official statistics should be kept in mind. Epidemiological field studies in occupational high-risk environments suggest that the extent of underreporting may be 50- to 100-fold higher than currently documented [22], [46], [60].

The operational efficiency of early prevention is presently being analyzed in a research project by the German Statutory Accident Insurance (Deutsche Gesetzliche Unfallversicherung, DGUV) at the University of Osnabrück (Quality Assurance and Evaluation of the Improved Dermatologist’s Procedure and the Multi-Step Intervention Approach to Skin Conditions (412.02:411.43-FB 130-EVA_Haut)). In this study, a random sample including 20% of all improved dermatologist’s procedures conducted in Germany are examined with respect to the implementation of the dermatologist’s procedure by medical doctors, the implementation of procedures of the multistep intervention approach to skin conditions by insurance administrations, and the interactions of involved institutions, while differentiating severity and course of the skin disease (1-year follow-up).

4. Tertiary prevention according to the Osnabrück Model

Occupational skin diseases represent a substantial expense factor for statutory accident insurances. Among all occupational diseases, they result in highest expenditures for insurers receiving occupational rehabilitation benefits (referred to as: measures supporting participation in professional life), per year. Among statutory accident insurance institutions, 60% of all beneficiaries of rehabilitation measures were insured persons with OD. At the same time, approximately 60% of all expenses for occupational rehabilitation were dedicated to this purpose [47]. Due to present economic conditions, expenditures for occupational rehabilitation (e.g., 2004: 62.5 million Euro for skin diseases) frequently do not achieve their stated objectives as claimants do not succeed in reintegrating into the employment market. On the one hand, this emphasizes the need for specific, early secondary prevention of OD, and on the other hand, the need to also create options to help affected individuals, where OD has already advanced to a severe, recalcitrant course in order to secure a professional future.

Severe occupational skin diseases that interfere with the continuation of occupational activity are frequent. In addition to follow-up costs incurred by the collective body of the insured, the significant degree of personal suffering caused by these diseases as well as the serious psychosocial consequences they entail for affected persons, must be considered in particular. These considerations should be made, namely, in the context of actual placement opportunities available during career shifting [45].

In Osnabrück, for more than 10 years we have gained experience with a model of quality-assured tertiary individual prevention (TIP), which combines all available options in the form of comprehensive multidisciplinary intervention for persons with severe OD, according to state-of-the-art scientific knowledge in the field (Osnabrück Model, Figure 5 [45], [65], [66], [67], [69], [70], [71], [72], [73], [81]).

The intensified measures of TIP are indicated, when the cessation of the harmful occupation, or the development of an occupational skin disease according to German Occupational Disease Ordinance Nr. 5101 (Berufskrankheitenverordnung) is imminent. TIP, according to the Osnabrück Model, combines in an inpatient phase of up to 3 weeks of dermatological consultation and therapy and health-related pedagogic and psychological motivation training with the objective of bringing about a fundamental change in skin protection behavior at the workplace (i.e., behavioral and – where possible – environmental prevention [45], [64], [68], [72], [81]). Complementary to these measures, the following prevention measures are also offered: ergotherapeutic exercises to test adequate skin protection methods in a simulation model of the workplace, counseling by the case manager of the accident insurance institution, and – whenever possible – involvement of the company medical officer/occupational physician. Subsequently, local dermatologists follow-up cases at close intervals, i.e., outpatient treatment covered by accident insurance institutions (BG-Heilverfahren; Figure 5).

Indications for TIP are predominantly chronic, toxic degenerative or allergic contact eczema, and occupational atopic hand eczema. Other OD, such as severe therapy-resistant occupational triggered psoriasis palmaris are also included. Moreover, the spectrum of indication is broadened by the (if necessary, repeated) treatment of older employees undergoing outpatient therapy refractory hand eczema, to stabilize skin conditions to the greatest extent possible (referred to as: refresher TIP).

From October 1994 to March 2007, more than 2,500 patients underwent TIP measures in Osnabrück. In the course of a recently conducted long-term evaluation of the measures employed (collectives 10/1994 – 09/2003), it was shown that in a follow-up of the Osnabrück cohort, 1 year after initiation of TIP, 66% of participants with severe hand eczema remained active in their respective occupations. In the past, these patients would have lost gainful employment, almost without exception (Figure 6) [71], [73]. The continuation of employment was found to be unrelated to type of risk occupation practiced (i.e., metalwork, construction, health care, hairdressing, food processing, cleaning), but was contingent upon the age of patients at the time of receiving TIP (Figure 7).

Accumu
Figure 5: Flow chart of TIP according to the Osnabrück Model, upon which the present multicentre study of the German Statutory Accident Insurance (DGUV) is based: modified inpatient treatment and integrated consecutive outpatient care by the referring dermatologist at patient’s place of residence

Overall period of abstention from work is approx. 6 weeks, to allow for complete regeneration of the skin barrier after severe damage [43], [71], [73].

Figure 6: Employment continuation 1 year after TIP measures have been employed in different high-risk occupations (cohort 10/1994–09/2003) [71], [73]

It can be shown that the comparatively low success rate in hairdressing does not result from an occupation-specific, but from an age-specific effect (i.e., a preponderance of younger age groups among the cohort of counseled hairdressers; among these age groups, the risk of career shifting is higher. Cf. Figure 7). N_{total}=1164
Logistic regression adjusted for implementation of advised prevention measures, supply of skin protection materials by employers, and implementation of outpatient medical treatment. $1 = \text{minimal risk of job loss}.\text{In the} < 20\text{-year-old age group, the risk of career change due to severe hand eczema is 5-fold higher than in the 40- to 50-year-old age group}[71],[73]. N_{tot}=1163$

The use of topical glucocorticosteroids coupled with abstention from allergens or noxa is indicated in cases of acute contact eczema. However, recently it has become increasingly apparent that adverse affects on epidermal barrier function are related to the regular use of glucocorticosteroids [28],[52],[53],[77]. Therefore, concomitant network- exposure and continuous glucocorticoid therapy are called into question. It was found that 90% of patients with chronic OD in our collective had a history of treatment with topical glucocorticosteroids, which was administered on a long-term daily regular bases in nearly 40% of cases. Due to adverse effects of long-term therapy with topical glucocorticosteroids on the epidermal barrier, which are induced by various pathomechanisms, TIP aims at steroid-free therapy to the greatest possible extent. To this end, among other treatments, like calcineurin-antagonists, classic dermatological externa such as shale oil in a disease stage-specific base, tannins and antiseptics, baths and irradiation such as local PUVA therapy (PUVA bath or cream therapy), as well as tap water iontophoresis for hyperhidrosis, are variously used. In total, at the time of discharge, complete freedom from dermatological symptoms or significant amelioration was observed in 84% of participants. In order to attain a complete regeneration of barrier function, it is necessary to allow for at least a total of 6 weeks of exposure abstinence after severe skin damage to the skin [49].

Affected persons, who are successfully convinced of the significance of prevention measures during TIP, frequently create a multiplier effect among other employees of an enterprise, even though they are not yet recipients of such prevention measures. This demonstrates that inpatient (and outpatient) prevention projects, which feature a setting-based approach, have an outreach effect on population strata in which health-conscious behavior is not a priority. It has become increasingly apparent that many affected persons confront the subject of (skin) health for the first time during these measures, and subsequently prove to be remarkably impressionable in terms of greater empowerment and increased personal responsibility. In this respect, it should be borne in mind that skin diseases are not to trifle with as commonly thought. In fact, the persistence of insufficiently treated chronic dermatoses frequently lead to permanent adverse impacts on future life prospects, also in social terms. Protracted phases of inability to work caused by eczema
all too frequently entail a decline into precarious employment relationships or even worse, long-term unemployment, which is followed by a significant loss of income and loss of what contributes to a person’s central identity in life.

One of the decisive factors in TIP is the consistent and seamless continuation of initiated medical and preventive efforts. Subsequent outpatient treatment, which is covered for by the concerned accident insurance institution and administered by the patient’s dermatologist, is always indicated and an essential component of TIP measures. Thus, it is a welcome fact that locally practicing dermatologists largely perceive TIP as an important addition to the spectrum of treatments offered in their practices.

Therefore, TIP exemplarily demonstrates options for efficient integrated care of patients (inpatient phase/outpatient treatment by the local dermatologist) [43]. It represents an essential move towards multi-step disease management in occupational dermatology. Its prospects for success appear to be particularly good within the extensive prevention mandate defined by Article 3 of the German Ordinance on Occupational Diseases (Berufskrankheitenverordnung, BKV; referred to as: by all adequate means). That is, dermatological diagnostics and treatment, which are defined according to disease stage, serve the interests of each patient and may proceed – in clinics and practices – without budgetary restrictions.

### 4.1 Nationwide multicentre study on tertiary individual prevention

Quality assurance of TIP’s further development appears to be an important task in future. Emphasis will be placed on the integrative character of prevention concepts, which will combine multidisciplinary measures to ensure a close integration of outpatient and inpatient treatment in terms of seamless care and patient counseling. It is in this way that TIP currently differs from classic inpatient rehabilitation measures for OD that are largely monodisciplinary in nature. Moreover, these are insufficiently united with necessary therapeutic and workplace-related measures. Analogous to this, there are no verifiable, authoritative quality standards for inpatient rehabilitation of OD. In the case of TIP, networked models as proposed by statutory health insurances [referred to as: integrated care, in Article 140 et seq. of the Social Code, Book V (Sozialgesetzbuch V)] can be realized. The central coordinating tasks of the “gate-keepers” as provided for in the concept of integrated care are performed by occupational disease administrators (BK-Sachbearbeiter), which manage related procedures. The administrator should turn to local dermatologists or, if applicable, to company medical officers for advice. The improved dermatologist’s procedure was created as a universal interactive information platform.

Accordingly, a nationwide multicentre research project of head organizations of statutory accident insurance institutions is presently being conducted to further develop multidisciplinary, inpatient–outpatient, networked treatment procedures, termed Medical-Occupational Rehabilitation Procedure for Skin Diseases – Improvement and Quality Assurance of Treatment (Medizinisch-berufliches Rehabilitationsverfahren Haut – Optimierung und Qualitätssicherung des Heilverfahrens; ROQ). The insurance staff responsible for collaborating in this study was comprehensively informed regarding study objectives. The study itself was decisively supported by nationwide kick-off events. Recruitment has taken place since November 2005. Project supervision rests with the University of Osnabrück and the University of Heidelberg (Prof. Dr. T. L. Diepgen). Other participating study centers include the Clinics for Occupational Diseases in Bad Reichenhall and Falkenstein, the latter in collaboration with the University Dermatological Clinic Jena (Prof. Dr. P. Elsner). The study is conducted as a prospective, controlled cohort study examining 1000 patients with severe OD. In addition to further quality assurance, the assessment of transferability to other centers and sustainability of the intervention is of particular importance. Studied patients in this cohort will receive regular dermatological follow-up examinations for 3 years. Herein, the issues of employment continuation, satisfaction at the workplace, and quality of life are recorded in particular, as well as disease history. A decisive operation manual and regular training of all centers ensure a uniform multidisciplinary approach based on the current state of knowledge in all participating clinics. Upon discharge, the designated treating dermatologist (and the accident insurance institution) receives comprehensive information on the prevention concept which has been developed together with the affected individual. Moreover, a standardized procedure on the occasion of discharge from inpatient treatment is established. Patients receive, at the expense of the accident insurance institution, a so-called starter-set which includes individually assessed, profession-specific skin protection materials, to provide for implementation of improved skin protection from the outset.

### 4.2 Perspectives

The proven collaboration of researchers with locally practicing dermatologists was crucial to the success of the Osnabrück Model. Thus, fundamental requirements formulated by the German Advisory Council on the Assessment of Developments in the Health Care System (Sachverständigenrat für das Gesundheitswesen) in 2001 (referred to by the council as: close interlocking of outpatient and inpatient medical care) were met exemplarily in terms of introducing improved patient care. The gathered data support the concept that dermatology in tertiary individual prevention is of particular importance. Studied patients in this cohort were comprehensively informed regarding study objectives. The study itself was decisively supported by nationwide kick-off events. Recruitment has taken place since November 2005. Project supervision rests with the University of Osnabrück and the University of Heidelberg (Prof. Dr. T. L. Diepgen). Other participating study centers include the Clinics for Occupational Diseases in Bad Reichenhall and Falkenstein, the latter in collaboration with the University Dermatological Clinic Jena (Prof. Dr. P. Elsner). The study is conducted as a prospective, controlled cohort study examining 1000 patients with severe OD. In addition to further quality assurance, the assessment of transferability to other centers and sustainability of the intervention is of particular importance. Studied patients in this cohort will receive regular dermatological follow-up examinations for 3 years. Herein, the issues of employment continuation, satisfaction at the workplace, and quality of life are recorded in particular, as well as disease history. A decisive operation manual and regular training of all centers ensure a uniform multidisciplinary approach based on the current state of knowledge in all participating clinics. Upon discharge, the designated treating dermatologist (and the accident insurance institution) receives comprehensive information on the prevention concept which has been developed together with the affected individual. Moreover, a standardized procedure on the occasion of discharge from inpatient treatment is established. Patients receive, at the expense of the accident insurance institution, a so-called starter-set which includes individually assessed, profession-specific skin protection materials, to provide for implementation of improved skin protection from the outset.

In light of the proven success of TIP, classic unidimensional inpatient treatments for severe OD should no longer be implemented. This has been stated in the Multi-step Approach to Skin Conditions (See internal workflow of accident insurance institutions for handling “skin disease
cases”, cf. paragraph 2). In this context, the benefit accrued for the collective body of the insured by timely and systematic prevention measures in cases of OD has been emphasized for the first time [23], [67]. Considering the frequently short period of time between the first report of occupational skin disease and the discontinuation of employment [47], it represents a welcome innovation for affected patients. This also indicates a departure from a predominantly curative approach and an orientation towards a preventive system. In fact, this was frequently called for recently by head organizations of statutory accident insurance institutions [29], and is in accordance with the current coalition agreement [4]. The text of the coalition agreement refers to the importance of prevention, particularly in the light of demographic change. However, occupational aspects are not mentioned in the agreement. Nevertheless, increasing weekly working hours and prolonging of working life span suggest that the number of OD cases will also rise. Contrary to popular assumption, female skin is no more sensitive than male skin, but skin sensitivity increases with age for both sexes. This further emphasizes the future significance of efficient dermatological intervention instruments, up to and including networked and integrated TIP. It is hoped that the multi-step prevention concepts presented herein may also support preventive medical approaches in other disciplines.

List of abbreviations

CO₂: carbon dioxide  
DIT: differential irritation test  
NaCl: sodium chloride  
NaOH: sodium hydroxide  
OD: occupational dermatoses  
PUVA: psoralen plus UVA  
ROS: reactive oxygen species  
SIP: secondary individual prevention  
SLS: sodium laurel sulfate  
SMART: swift modified alkali resistance test  
TEWL: transepidermal water loss  
TIP: tertiary individual prevention

Notes

Conflict of interest

The author declares no competing interests.

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References

1. Allmers H, Schmengler J, John SM, Schwanitz HJ. Primärprävention der Typ-I-Allergie gegen Latex aus Naturkautschuk im deutschen Gesundheitswesen. Allergo J. 2005;14(5.1):329-36.  
2. Allmers H, Schmengler J, John SM. Decreasing incidence of occupational contact urticaria caused by natural rubber latex allergy in German health care workers. J Allergy Clin Immunol. 2004;114(2):347-51. DOI: 10.1016/j.jaci.2004.02.054  
3. Allmers H, Schmengler J, Skudlik C. Primary prevention of natural rubber latex allergy in the German health care system through education and intervention. J Allergy Clin Immunol. 2002;110(2):318-23. DOI: 10.1067/mai.2002.126461  
4. Anonymus. Koalitionsvertrag zwischen CDU, CSU und SPD "Gemeinsam für Deutschland - Mit Mut und Menschlichkeit". Berlin. 11.11.2005.  
5. Batzdorfer L, Schwanitz HJ. Direkte und indirekte Kosten berufsbedingter Hauterkrankungen. Arbeitsmed Sozialmed Umweltmed. 2004;39(11):578-82.  
6. Bauer A, Kelterer D, Stadeler M, Schneider W, Kleesz P, Wolllin U, Eisner P. The prevention of occupational hand dermatitis in bakers, confectioners and employees in the catering trades: preliminary results of a prevention program. Contact Derm. 2001;44(2):85-8. DOI: 10.1034/j.1600-0536.2001.440205.x  
7. Bergmann K, Müskén H, Kutane Tests. In: Przybilla B, Bergmann KC, Ring J, Hrsg. Praktische allergologische Diagnostik. Darmstadt: Steinkopff Verlag; 2000. p. 9-22.  
8. Blome O, Bernhard-Klîmt C, Brandenburg S, Dieggen TL, Dostal W, Drexler H, Frank KH, John SM, Kleesz P, Schindera I, Schmidt A, Schwanitz HJ. Bamberger Merkblatt. Begutachtungsempfehlungen für die Berufskrankheit Nr. 5101 der Anlage zur BKV. In: Szliska C, Brandenburg S, John SM, Hrsg. Berufsdermatosen. 2. Aufl. München Deisenhofen: Dustri Verlag Dr. Karl Feistle; 2006. p. 395-413.  
9. Blome O, Bernhard-Klîmt C, Brandenburg S, Dieggen TL, Dostal W, Drexler H, Frank KH, John SM, Kleesz P, Schindera I, Schmidt A, Schwanitz HJ. Begutachtungsempfehlungen für die Berufskrankheit Nr. 5101 der Anlage zur BKV, Dermatol Beruf Umwelt/Occup Environ Dermatol. 2003;51(1):D2-D14.  
10. Blome O, John SM. Das Hautarztverfahren. Die BG. 2007;1:27-31.  
11. Bock M, Damer K, Wulfhorst B, John SM. Effect of semi-permeable glove membranes on skin barrier repair following SLS-irritation: unique options for prevention. Oral presentation. 15th International Symposium on Contact Dermatitis (ISCD) in conjunction with the 5th International Symposium on Irritant Contact Dermatitis (ISCID); 08.11.2005; Paphos, Cyprus. 2005.
42. John SM, Skudlik C, Römer W, Blome G, Brandenburg S, Diepgen TL, Harwerth A, Köllner A, Pohrt U, Rogosky E, Schindera I, Stary A, Worm M. Leitlinie Hautarztverfahren der Arbeitsgemeinschaft für Berufs- und Umweltdermatologie (ABD). Dermatol in Beruf Umwelt/Occup Dermatol Environ. 2006;54:101-3.

43. John SM, Skudlik C. Neue Versorgungsformen in der Dermatologie: Vernetzte stationär-ambulante Prävention von schweren Berufsdarmosen - Eckpunkte für eine funktionierende integrierte Versorgung in Klinik und Praxis. [New forms of management in dermatology. Integrated in patient-out-patient prevention of severe occupational dermatoses: cornerstones for an effective integrated management in clinics and practices]. Gesundheitswesen. 2006;68:769-74.

44. John SM, Uter W. Meteorological influence on NaOH irritation varies with body site. Arch Derm Res. 2005;296(7):320-6.

45. John SM. Chancen und Grenzen der stationären Prävention von Berufsdarmosen. In: Berufsgenossenschaft der keramischen Glas-Industrie, Hrsg. Berufsbedingte Haut- und obstruktive Atemwegserkrankungen. Arbeitsmedizinisches Kolloquium Bad Reichenhall 2005. Heidelberg: Dr. Curt Haefner-Verlag; 2006. p. 19-32.

46. John SM. Epidemiologie berufsgedoteter Hauterkrankungen. In: Schwanitz HJ, Wehrmann W, Brandenburg S, John SM, Hrsg. Gutachten Dermatologen. Darmstadt: Steinkopf-Verlag; 2003. p. 3-16.

47. John SM. Hautarztverfahren: Universelle Plattform für die dermatologische Frühintervention. In: Sliaska S, Brandenburg S, John SM, Hrsg. Berufsdarmosen. 2. Auf!. München Deisenhofen: Dustri Verlag Dr. Karl Feistle; 2003. p. 517-46.

48. John SM. Hautirritabilitätstests. In: Sliaska S, Brandenburg S, John SM, Hrsg. Berufsdarmosen. 2. Auf!. München Deisenhofen: Dustri Verlag Dr. Karl Feistle; 2006. p. 581-9.

49. John SM. Klinische und experimentelle Untersuchungen zur Diagnostik in der Berufsdermatologie. Konzeption einer wissenschaftlich begründeten Qualitätssicherung in der sozialmedizinischen Begutachtung. Studien zur Prävention in Allergologie, Berufs- und Umweltdermatologie (ABU), Bd. 4. Osnabrück: Universitätsverlag Osnabrück; 2001.

50. John SM. Objectifying primary and acquired sensitive skin. In: Berardesca E, Flihu J, Maibach H, editors. Sensitive skin syndrome. New York: Taylor & Francis; 2006. p. 129-47.

51. John SM. Verfahren zur Früherfassung beruflich bedingter Hautkrankheiten (Hautarztverfahren). In: Schwanitz HJ, Wehrmann W, Brandenburg S, John SM, Hrsg. Gutachten Dermatologen. Darmstadt: Steinkopf-Verlag; 2003. p. 33-59.

52. Kao JS, Flihu JW, Man MQ, Fowler AJ, Hackem JP, Crumrine D, Ahn SK, Brown BE, Elias PM, Feingold KR. Short-Term Glucocorticoid Treatment Compromises Both Permeability Barrier Homeostasis and Stratum Corneum Integrity: Inhibition of Epidermal Lipid Synthesis Accounts for Functional Abnormalities. J Invest Dermatol. 2003;120(3):456-64. DOI: 10.1046/j.1523-7242.2003.12053.x

53. Kolbe L, Kligman AM, Schreiner V, Stoumdayer M, Covicostoid-induced atrophy and barrier impairment measured by non-invasive methods in human skin. Skin Res Technol. 2001;7:73-7. DOI: 10.1046/j.1600-0846.2001.070203.x

54. Küttig B, Diepgen T, Schmid K, Drexl H. Überlegungen zu notwendigen Konsequenzen für arbeitsmedizinische Vorsorgeuntersuchungen durch die Novellierung der Gefahrstoffverordnung am Beispiel der Vorsorgeuntersuchungen für Hauterkrankungen und obstruktive Atemwegserkrankungen. Arbeitsmed Sozialmed Umweltmed. 2005;40:308-12.

55. Lachapelle JM, Wigger-Alberti W, Bomann A, Meilström GA, Wulfhorst B, Bock M, Skudlik C, John SM, Perrenoud D, Gogniat T, Olmstead W, Heid E, Agner T. Prevention and Therapy. In: Frosh PJ, Mennel T, Lepoittevin JP, editors. Contact Dermatitis. Berlin, Heidelberg: Springer; 2006. p. 831-67.

56. Locher G. Permeabilitätsprüfung der Haut Ekzemkranker und Hautgesunder für den neuen Indikator Nitrazingelb „Geige“. Modiﬁzierung der Alkaliresistenzprobe, pH-Verlauf in der Tiefe des stratum corneum. Dermatologica. 1962;124:159-82.

57. McLean WH, Hull PR. Breach delivery: increased solute uptake points to a defective skin barrier in atopic dermatitis. J Invest Dermatol. 2007;127:8-10. DOI: 10.1038/sj.jid.5700609

58. Perkins MA, Osterhues MA, Farage MA, Robinson MK. A noninvasive method to assess skin irritation and compromised skin conditions using simple tape adsorption of molecular markers of inﬂammation. Skin Res Technol. 2001;7(4):227-37. DOI: 10.1034/j.1600-0846.2001.70040.x

59. Przybilla B, Schnuch A, Aberer W, Agathos J, Brasch J, Frosh PJ, Fuchs T, Richter G. Durchführung des Epikutantests mit Kontaktallergenen. In: Korting HC, Callies R, Reusch M, Schlaeger M, Sterry W, Hrsg. Dermatologische Qualitätssicherung, Leitlinien und Empfehlungen. Gernerung: Zuckschwerd Verlag; 2003. p. 307-12.

60. Riehl U. Interventionenstudie zur Prävention von Hauterkrankungen bei Auszubildenden des Friseurhandwerks. Studien zur Prävention in Allergologie, Berufs- und Umweltdermatologie (ABU), Bd. 3. Osnabrück: Universitätsverlag Rasch; 2001.

61. Schultze J. Paradigmenwechsel: Von der Prävention zur Prädiktion. In: Michna H, Oberender P, Schultze J, Wolf J, Hrsg. „... und ein langes gesundes Leben“. Prävention auf dem Prüfstand: Wieviel organisierte Gesundheit - wieviel Eigenverantwortung? II. Interdisziplinärer Kongress Junge Naturwissenschaft und Praxis; 8.-9. Juni 2006; Köln. Köln: Hans Martin Schleyer-Stiftung; 2006. p. 53-9.

62. Schwanitz HJ, Batzdorfer L, John SM. Forschungsbericht 1987-2002 ("Halbzeit"). Studien zur Prävention in Allergologie, Berufs- und Umweltdermatologie (ABU), Bd. 6. Göttingen: v&R Unipress; 2003.

63. Schwanitz HJ, John SM. Untersuchungen zur Nachhaltigkeit des Osnabrücker Hautschutzmodells bei Friseuren und Altenpflegern. In: BGN, Hrsg. 10. Erfurter Tage. Prävention von arbeitsbedingten Gesundheitsgefahren und Erkrankungen. Leipzig : Monade; 2004. p. 334-40.

64. Schwanitz HJ, Riehl U, Schlesinger T, Bock M, Skudlik C, Wulfhorst B. Skin care management: educational aspects. Int Arch Occup Environ Health. 2003;76(5):374-81. DOI: 10.1007/s00420-002-0428-z

65. Schwanitz HJ. Akute Ergebnisse zur Prävention von Berufsdarmosen. In: Schwanitz HJ, Sliaska C, Hrsg. Berufsdarmosen. München: Dustri-Verlag; 2001. p. 12.1-12.9.

66. Schwanitz HJ. Tertiäre Prävention von Berufsdarmosen. Dermatol Beruf Umwelt/Occup Environ Dermatol. 2002;50:212-7.

67. Skudlik C, John SM. Stufenverfahren Haut. Praktische Umsetzung aus dermatologischer Sicht. Trauma Berufskrankh. 2007;9(4):374-81. DOI: 10.1007/s10039-007-1284-6

68. Skudlik C, Proske S, Schwanitz HJ. Irritativ-provoziertes atopisches Ekzem. In: Fuchs T, Aberer W, Hrsg. Kontaktekzem. München-Deisenhofen: Dustri-Verlag Dr. Karl Feistle; 2002. p. 8d.1-8d.7

69. Skudlik C, Schwanitz HJ. Tertiäre Prävention von Berufsdarmosen bei Metallarbeitern im Jahr 2002. Dermatol Beruf Umwelt/Occup Environ Dermatol. 2004;2:54-61.
70. Skudlik C, Schwanitz H-J. Tertiäre Prävention von Berufsdermatosen/Tertiary prevention of occupational skin diseases. J Dtsch Dermatol Ges. 2004;2(6):424-33. DOI: 10.1046/j.1439-0353.2004.04783.x

71. Skudlik C, Wulfhorst B, Gediga G, Bock M, Allmers H, John SM. Tertiäre Individualprävention von Berufsdermatosen/a decade's experience with recalcitrant occupational dermatitis. Int Arch Occup Environ Health. 2008;81(8):1059-64. DOI: 10.1007/s00420-008-0300-x

72. Skudlik C, Wulfhorst B, John SM. Tertiäre Individual-Prävention (TIP): Modifiziertes stationäres Heilverfahren bei Berufsdermatosen. In: Szliska S, Brandenburg S, John SM, Hrsg. Berufsdermatosen. 2. Aufl. München: Deisenhofen: Dustri Verlag Dr. Karl Feistle; 2006. p. 571-9.

73. Skudlik C, Tertiäre Individuálna preventión (TIP) in der Berufsdermatologie. Untersuchungen zu einem vernetzten stationären und ambulanten interdisziplinären Präventionskonzept. Studien zur Prävention in Allergologie, Berufs- und Umweltdermatologie (ABU), Bd. 8. Göttingen: V&R Unipress; 2007.

74. Tupker R. Prediction of irritancy in the human skin irritancy model and occupational setting. Contact Dermatitis. 2003;49(2):61-9. DOI: 10.1111/j.0105-1873.2003.00171.x

75. Ummenhofer B. Zur Methodik der Alkaliresistenzprüfung. Dermatosen. 1980;28:104-9.

76. Uter W. Epidemiologie und Prävention von Handekzemen in Feuchtberufen am Beispiel des Friseurhandwerks. Studien zur Prävention in Allergologie, Berufs- und Umweltdermatologie (ABU), Bd. 2. Osnabrück: Universitätsverlag Rasch; 1999.

77. Van der Vaik PG, Maibach HI. Do topical corticosteroids modulate skin irritation in human beings? Assessment by transepidermal water loss and visual scoring. J Am Acad Dermatol. 1989;21:519-22. DOI: 10.1016/S0190-9622(89)70219-X

78. Wahlberg JE. Patch testing. In: Rycroft RUG, Menné T, Frosch PJ, Lepotittevin J, editors. Textbook of contact dermatitis. Berlin, Heidelberg, New York: Springer Verlag; 2000. p. 435-68.

79. Weisshaar E, Radulescu M, Bock M, Albrecht U, Diepgen TL. Educational and dermatological aspects of secondary individual prevention in healthcare workers. Contact Dermatitis. 2006;54(5):254-60. DOI: 10.1111/j.1065-1426.2006.00811.x

80. Weisshaar E, Radulescu M, Bock M, Albrecht U, Zimmermann E, Diepgen TL. Hautschutzseminare zur sekundären Individualprävention bei Beschäftigten in Gesundheitsberufen: Erste Ergebnisse nach über 2-jähriger Durchführung. J Dtsch Dermatol Ges. 2005;3(1):33-8. DOI: 10.1046/j.1439-0353.2005.04798.x

81. Wulfhorst B, Bock M, Skudlik C, John SM. Worker Education and Teaching Programs: The German Experience. In: Frosch P, Menné T, Lepotittevin J, editors. Contact dermatitis. Berlin, Heidelberg, New York: Springer; 2006. p. 855-61.

82. Wulfhorst B, Schwanitz H-J, Bock M. Optimizing Skin Protection with Semipermeable Gloves. Dermatitis. 2004;15(4):184-91. DOI: 10.2310/6620.2004.04016

83. Wulfhorst B. Konzeption, Implementation und Evaluation gesundheitspädagogischer Maßnahmen. Studien zur Prävention in Allergologie, Berufs- und Umweltdermatologie (ABU), Bd. 5. Osnabrück: Universitätsverlag Rasch; 2001.

84. Wulfhorst B. Skin Hardening in Occupational Dermatology. In: Kanerva L, Eilsner P, Wahlberg J, Maibach H, editors. Handbook of Occupational Dermatology. Berlin, Heidelberg, New York: Springer; 2000. p. 115-21.

85. Wulfhorst B. Theorie der Gesundheitspädagogik. Legitimation, Aufgabe und Funktionen von Gesundheitserziehung. Weinheim, München: Juventa; 2002.

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