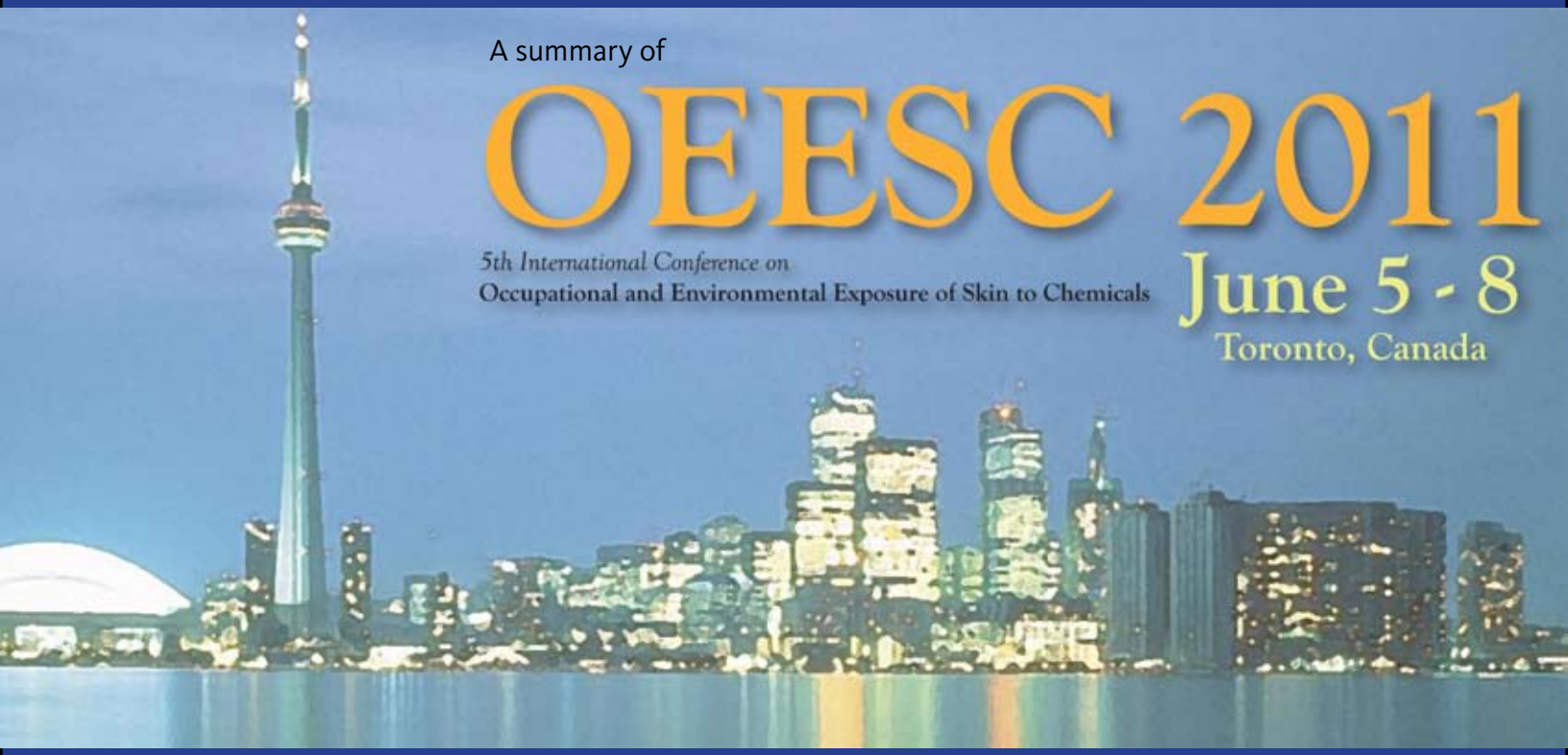
A Decade of Progress, a Decade of Promise

Going the distance to prevent occupational and environmental skin exposures



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OVERVIEW: ABOUT THE CONFERENCE

Occupational and Environmental Exposure of Skin to Chemicals Conference (OEESC) Fifth International Meeting Toronto, June 5-8, 2011

Nearly a decade has passed since the inaugural OEESC took place in 2002 in Washington, DC. Significant progress has been made with regards to knowledge and awareness of dermal exposure and diseases. The OEESCs with their multidisciplinary approach and plenary sessions have contributed substantially to knowledge exchange between researchers and practitioners around the world. Although many of the themes explored at this conference will look familiar, for each of the plenary sessions, the goal was to have keynote speakers summarize advancements achieved during the "Decade of Progress" and provide their vision for the "Decade of Promise," where the ultimate goal was *delivering* the science (i.e., knowledge exchange) in a form that practitioners can readily implement.

Participants

One hundred forty one professionals attended the conference from 15 countries including: Canada, United States, United Kingdom, France, Belgium, the Netherlands, Germany, Italy, Denmark, Sweden, Australia, Singapore, Japan, Tawain and South Africa. A variety of disciplines were represented including physicians (dermatology, occupational medicine, allergy, family medicine, plastic surgery), nursing, occupational therapy, pharmacy, occupational hygiene, epidemiology, toxicology, biochemistry, physiology, biomedical engineering, health administration and public health sciences. The participants came from academia, government, healthcare and industry.

UNIVERSITIES/ACADEMIC MEDICAL CENTRES REPRESENTED:

- **Canada:** Centre du recherche CHUM; McMaster University; University of British Columbia; University of Ottawa; University of Toronto
- **USA:** Cleveland Clinic; Harvard School of Public Health; Northern Illinois University; University of Georgia; University of Massachusetts, Lowell; University of North Carolina, Chapel Hill; University of Washington; Yale University
- **Europe:** Academic Medical Centre/Coronel Institute of Occupational Health, University of Amsterdam, The Netherlands; Institute of Occupational Medicine, UK; Karolinska Institutet, Sweden; Newcastle University, UK; Saarland University, Germany; Salford Royal NHS Foundation Trust, UK; TNO – Netherlands Organization for Applied Scientific Research, The Netherlands; Umea University, Sweden; University of Aberdeen, UK; University of Copenhagen, Denmark; University of Heidelberg, Germany; University of Hertfordshire, UK; University of Leuven, Belgium; University of Manchester, UK; University Medical Centre, University of Groningen, The Netherlands; University of Osnabrueck , Germany; University of Siena, Italy; University of Trieste, Italy
- **Australia, Asia and Africa:** China Medical University, Taiwan; Kumamoto University, Japan; Monash University, Melbourne Australia; NorthWest University, South Africa; Skin and Cancer Foundation Victoria, Australia; University of Melbourne, Australia

GOVERNMENT ORGANIZATIONS REPRESENTED:

- **Canada:** Alberta Employment and Immigration and Workplace Standards; City of Toronto; Environment Canada; Health Canada; Ontario Ministry of Labour; Ontario Workplace Safety and Insurance Board; Public Health Ontario (OAHPP); Workplace Safety and Prevention Services; WorkSafe BC
- **USA:** CDC/NIOSH
- **Europe:** France Agency for Food, Environment and Occupational Health and Safety; Health Protection Agency, UK Health and Safety Executive, UK; Swedish Defence Research Agency
- **Asia:** Ministry of Manpower, Singapore

Program

The conference began with a workshop focused on methods of assessment of skin conditions, organized by Aleksandr Stefaniak, NIOSH. The outputs from this one-day session are two papers outlining the guidelines for the in vivo assessment of skin properties in workplace settings.

A second workshop on the clinical aspects of occupational and environmental skin disease served as both a current review of the basics of contact dermatitis and six presentations on current research and practice. The workshop was co-chaired by Melanie Pratt (Canada), Rosemary Nixon (Australia) and Swen John (Germany). Review presentations included diagnosis, interesting cases and prevention in the clinical context. Submitted abstracts presentations included variation in allergen content in patch test preparations over time, impact of a multidisciplinary team and dedicated return-to-

work coordinator, integrated in-patient/outpatient rehabilitation program and patient safety tools.

These workshops were followed by a presentation on knowledge translation that introduced several of the KT initiatives that would occur over the course of the conference.

Five sessions took place to explore the themes below. See the following pages for a more detailed description of the sessions.

Defining the problem, health effects, burden of disease, causation and outcomes. The goal of the keynote(s) for this session was to summarize the current state-of-the-art knowledge with respect to burden of disease, causation and outcomes. Future expectations/challenges were presented.

From the outside in: penetration, uptake and metabolism of skin exposures and their modifying factors. The goal of the keynote(s) for this session was to summarize the state-of-the-art knowledge on how chemicals penetrate the dermal barrier: how chemicals are metabolized; how these mechanisms result in disease; and the factors that modify these processes. Future expectations/challenges were presented.

Exposure assessment: models, measurements and monitoring. The goal of the keynote(s) for this session was to summarize the state-of-the-art knowledge on methods for assessing dermal exposure (questionnaires, measurement, biomonitoring, prediction models), including the validation of new approaches and the development of scenario-based modeling techniques. Future expectations/challenges were addressed.

Prevention of occupational & environmental skin disease. The goal of these sessions was to summarize the current state-of-the-art knowledge for the prevention of occupational and environmental related skin disease at the workplace, governmental and societal levels. An international panel commented as to the feasibility of the various prevention methodologies in their jurisdiction. Future expectations/challenges were addressed.

The final half day consisted of three workshops: Cancer (Paul Demers, Rosemary Nixon); Lung-Skin Interactions (John Cherrie, Victoria Arrandale and Ian Kimber); and Risk Assessment and Management (Chris Packham).

Summary of Participants' Recommendations: Strategies for Future Work

Scope:

- Expand our focus from contact dermatitis to other occupational skin disease such as cancers and systemic toxicity that can result from skin exposure
- Improve our understanding of the significance of dermal exposure

Research:

- Understand the importance of data collection, notification and surveillance and advocate for its collection to improve the understanding of the burden of occupational skin disease
- Continue research – understanding mechanisms, modeling of exposure, high quality intervention studies for prevention and treatment, economic impact
- Improve prevention – by addressing both skin specific measures such as elimination, technical measures, personal protective equipment, work organization and general preventive approaches for occupational health and safety such as organizational culture, safety climate

Collaboration:

- Foster a multidisciplinary approach – for research, knowledge translation and practice
- Develop an approach for "globalization" regarding skin awareness and workplace factors
- Promote a coordinated effort (exposure limits, controls, sampling and analytical methods) looking at dermal exposures as has been done with inhalation exposure including:
  - Methods to characterize dermal exposures
  - Public health surveillance
  - Risk assessment methods
  - Control methods and risk management practices
- Enhance collaboration to standardize how to measure biologically relevant exposures including a common measurement scheme and increase connection between measurement and modeling; use same indices and assessment instruments

Knowledge Translation:

- Continue to develop targeted initiatives – different sectors, vulnerable workplaces, vulnerable workers
- Continue knowledge translation efforts to lead to change in practice – e.g., exposure assessment and modeling, diagnosis and treatment
- Continue lobbying for regulatory and policy initiatives – work together, build on success in other jurisdictions (share jurisdictional information)

Clinical Practice:

- Continue to develop evidence-based guidelines
- Educate physicians regarding work-related problems and occupational health professionals regarding skin exposure - its effects, assessment and prevention, practical solutions
- Improve access to diagnostic and treatment services

Session Summaries

SESSION 1: Defining the Problem: Health Effects, Burden of Disease, Causation and Outcomes

SESSION 2: From the Outside In: Penetration, Uptake and Metabolism of Skin Exposures and Their Modifying Factors

SESSION 3: Exposure Assessment Models, Measurement and Monitoring

SESSION 4: Prevention of Occupational Skin Disease: Workplace Focus

SESSION 5: Prevention of Occupational and Environmental Skin Disease: Regulatory and Societal Focus

SESSION 1

Defining the Problem: Health Effects, Burden of Disease, Causation and Outcomes

The first session, chaired by Melanie Pratt (Canada), served to set the stage for the remainder of the conference – namely to describe the effects of skin exposure if prevention efforts fail.

Thomas Deipgen (Germany) provided an overview on the epidemiology of contact dermatitis including causation, burden of disease, prevention and also noted the importance of skin cancer as an occupational skin disease. He pointed out that occupational contact dermatitis (OCD) is the most common occupational disease in many European countries with incidence rates varying between 0.5-1.9/1000 workers. However, OCD is under-estimated and under-reported. Commonly affected groups include: hairdressers, bakers and pastry chefs, florists, tile setters, electronics, machinists and healthcare workers. The two most important types of OCD are irritant (ICD) and allergic (ACD). Prevalence rates may vary between 10% and 20% in workers exposed to wet work. Often there is a combination of individual susceptibility and workplace exposures. At times, workers will have a combination of ICD, ACD and atopic dermatitis.

Risk factors for OCD include wet work, contact with skin irritants and allergens and atopic dermatitis. Wet work is defined as performing the work for a major portion of the work shift (i.e., regularly for more than two hours per day with hands in a wet environment or frequent/intense hand washing or wearing protective gloves for a corresponding period).

Dr. Diepgen pointed out the importance of carefully conducted patch testing in the diagnostic process, including not only commercial allergens but also the workers own products. In German experience, over half of workers seen in the German network have patch testing with their own workplace products.

OCD has a substantial impact. It has a high impact on both the affected worker and society more generally with impaired quality of life, increased risk of job loss and prolonged sick leave. It tends to be a chronic disease with 50% of those affected continuing to have symptoms 15 years after the onset. German experience finds that 20% are on sick leave for more than seven days and 10% experience a job change. There is considerable social stigma as it often occurs on highly visible skin (hands, face) and may result in anxiety, low self-esteem and social phobia. Outcomes may be poor. A Swedish follow-up study found 70% with ongoing symptoms in the previous year and one third had continuous symptoms. Economic costs may be high, with both direct medical costs plus loss of productivity, sick leave, re-training and compensation.

Dr Diepgen then discussed the hope of prevention. He reviewed the various German regulations targeting skin exposures (wet work, hairdressers, sensitizing substances, healthcare and chromate in cement). He emphasized the importance of substitution (latex, chromate), allergen avoidance and skin protection measures including gloves, lifestyle changes and education. He reviewed the case of the hairdressing industry in Germany where a targeted prevention campaign has occurred. A significant decrease in compensation claims and costs has been seen.

Finally, Dr. Diepgen noted the issue of skin cancer, an often forgotten occupational skin disease. He particularly focused on UV exposure and squamous cell carcinoma. He made the case for inclusion of skin cancer in discussions of occupational skin disease.

Tove Agner (The Netherlands) continued with the theme and focused on outcomes including quality of life. Dr. Agner reinforced many of the findings presented by Dr Diepgen. She noted incidence rates of 5.5/1000 person years and a one year prevalence of 10%. Occupational hand dermatitis is the most frequently recognized occupational disease in Denmark and also the most costly in terms of workers' compensation.

Dr. Agner discussed diagnosis and noted that patch testing should be undertaken for hand eczema persisting for longer than one month.

Dr. Agner focused on prognosis and outcomes. Poorer prognosis has been associated with older workers, atopic dermatitis with no differences found between gender and ICD vs. ACD. A low quality of life is associated with prolonged sick leave and job loss. Risk factors for chronicity include history of atopic dermatitis and extent of involvement.

Dr. Agner discussed the assessment of severity noting several different scoring methods including the HECSI. She also presented a visual scoring assessment from Coenraads. Assessment of quality of life may include global assessments such as the SF36 and dermatology-specific scoring methods such as the DLQI. Other problems that may arise are colonization by Staphylococcus aureus.

Dr Agner also described the German prevention and rehabilitation initiatives. For those with severe disease, an intensive program follows including

three weeks of in-patient treatment. The importance of education was stressed. A recent study of healthcare workers found that the prognosis was influenced by identifying a precise diagnosis, exposure assessment and change and information/education of the patient. Other factors affecting prognosis included delay in seeking treatment and challenges with information related to the content of products.

Future aspects and challenges included: education, focus on atopic dermatitis, importance of the correct diagnosis, minimizing delay in diagnosis, better product content information and substitution of chemicals.

There were then six short abstract-driven presentations including complaints related to the indoor environment; exposure to wet work; recognizing risk factors for persistent dermatitis; estimating occupational exposure to skin carcinogens in Canada; exposures in leather factories in Indonesia and hand eczema in Danish hairdressers and several posters.

SESSION 2

From the Outside In: Penetration, Uptake and Metabolism of Skin Exposures and Their Modifying Factors

The second session, chaired by Fred Frasch (USA) included presentations on mechanisms of chemical effects in the skin by Ian Kimber (UK); permeation of chemicals through the skin by Simon Wilkinson (UK); and factors modifying the uptake of chemicals through the skin by Sanja Kezic (The Netherlands). The keynote presentations were followed by two parallel abstract-driven sessions as well as 22 posters relevant to the topics in both Sessions 2 and 3.

Professor Kimber opened Session 2 with a keynote talk titled: "Mechanisms of Chemical Effect in the Skin" in which he discussed the potential mechanisms through which chemicals cause allergic sensitization following skin contact. Different types of chemical allergen induce variable qualities of adaptive immune response characterized by preferential T helper (Th) cell development and cytokine secretion. Some chemicals cause skin sensitization resulting in allergic contact dermatitis. Topical exposure to other chemicals, however, induces selective Th2 cell development and the quality of immune response required for effective sensitization of the respiratory tract.

Professor Kimber spoke in detail about the role of the Langerhans and dendritic cells in the immune response to chemical exposure in the skin and airways. Most interestingly, Professor Kimber described the different times taken for these cells to migrate to the local lymph nodes from the skin. A delay in migration seems to increase the probability of a Th2 response.

The mechanistic differences between a Th1 and a Th2 response were also described, specifically, how the Th1 cytokines reduce the likelihood of specific IgE production by the B cells, while Th2 cytokines actually increase IgE production.

The differential cytokine profiles produced by known respiratory and skin sensitizers, such as trimellitic anhydride (TMA) and dinitrochlorobenzene (DCNB) were described. These cytokine profiles may provide a basis for determining whether a chemical will cause sensitization of the skin or respiratory system.

Professor Kimber also mentioned how the specific chemical exposure can impact the immune response. For example, skin exposure to trimellitic anhydride (TMA) results in a release of interleukin 10 (IL-10) that in turn inhibits TNFα production thereby delaying the migration of Langerhans from the skin which will favor the selective development of a Th2-type response.

Dr. Simon Wilkinson was the second speaker in Session 2 and spoke about the "Permeation of chemical through the skin". First, Dr. Wilkinson reviewed the structure of the skin layers, from the outside in: stratum corneum, viable epidermis, dermis, systemic circulation. The stratum corneum is a physical barrier, composed of dead cells that are at the end of the skin cell life cycle and are sloughed off frequently.

Penetration into the systemic circulation can occur through two physical routes: transcellular (across cells) or intercellular (between or around cells). Both of these routes can be visualized using the bricks and mortar model of the skin layers where the bricks represent the corneocytes and the mortar represents the lipids.

Dr Wilkinson described both physical and biochemical barriers to penetration. In addition to the physical barrier of the stratum corneum, metabolism can also act as a biochemical barrier when enzymatic activities affect the chemical structure of exposures and transform them before reaching the systemic circulation.

The vehicle continuing the exposure of concern can also have significant effects on the penetration of exposures. This may occur in many ways; as penetration is a diffusive process, the concentration of the exposure in the vehicle can affect the rate of diffusion. Additionally, volatile vehicles will leave a (high concentration) layer of solute on the skin. Alternatively, the use of moisturizers will increase the barrier function and decrease permeability of the skin layer.

Dr. Wilkinson discussed the role of appendages (hairs and hair follicles) in permeation, which is a controversial area of research. Permeation may occur through hair follicles or through sebaceous glands, thus bypassing the "normal" route of trans- or intercellular permeation routes. This is a theoretically viable route of dermal absorption with a shorter distance of absorption as the sebaceous gland has no stratum corneum, though the hair follicle does.

The final speaker of Session 2 was Dr. Kezic who spoke about "Factors modifying the uptake of chemical through the skin." Dr. Kezic separated the factors affecting the uptake of chemicals through the skin into environmental factors and intrinsic factors.

Many environmental factors can affect the skin barrier, particularly the skin hydration level (wet work, humidity, wearing gloves), exposure to water, soap, detergent, chemicals, as well as mechanical damage. Soaps and detergents result in disorder within the lipid bilayer, decrease cohesion of the stratum corneum, lead to inflammation and increase the permeation of chemicals into the skin. Solvents denature proteins and also disrupt the lipid bilayer which can actually increase their own absorption into the skin and systemic circulation.

The main intrinsic factor affecting skin barrier function is the existence (or history of) skin disease, including atopic dermatitis, ichthyosis vulgaris and psoriasis, among others. Patients with atopic dermatitis (AD) are at risk of occupational contact dermatitis (OCD). AD is also associated with the Flg loss of function gene; patients with the Flg loss of function gene have lower levels of filaggrin protein in their skin. Filaggrin is a natural moisturizing protein and also adds mechanical strength to the skin barrier. The presence of AD or the Flg loss of function mutation both result in increased skin diffusivity.

When the skin barrier is disrupted there is more penetration of chemicals as well as penetration of larger molecules than would normally penetrate under normal conditions. The effects of this increased permeability can result in both local and systemic effects, and thus there is a need to maintain proper skin barrier through proper hydration techniques.

SESSION 3

Exposure Assessment Models, Measurement and Monitoring

The third session, chaired by Aleksandr Stefaniak (USA) included presentations on dermal exposure assessment by John Cherrie (Scotland); models for predicting dermal exposure by Dhimiter Bello (USA); and bio-monitoring by Adam Wisnewski (USA). The keynote presentations were followed by two parallel abstract-driven sessions.

Session 3 was opened by a keynote address from Dr. John Cherrie titled: "Dermal Exposure Assessment: Progress and Pitfalls." Dr. Cherrie cited the increased interest in skin exposure assessment as one of the points of progress. This increased interest is demonstrated by more publications on skin exposure, however, despite these increases there are still relatively few publications that report skin exposure measurements, many fewer publications as compared to airborne exposure measurement.

One of the pitfalls when comparing skin and airborne exposure values is that these two exposure measurements

are measured in different units. Skin exposures are measured in units of mass/area, flux or surface area, while airborne exposure measurements are measured in mass/volume or parts of chemical per million (or billion) parts of air.

Dr. Cherrie emphasized that dermal exposure measurements are usually undertaken in research studies and are not used for control or exposure monitoring activities. This may be due to several factors: there are problems with interpretation due to limited understanding of the attenuating effect of personal protective equipment (PPE) and the lack of common and standardized methods. Recently, there has been progress towards a biologically relevant sampler; these developments are promising (National Institute of Occupational Health and Safety (NIOSH), Institute of Occupational Medicine (IOM).

Looking forward, Dr. Cherrie sees a need for biologically relevant measurements as well as a better understanding of the modifying effects of PPE. Collectively, we need a clear research agenda, increased collaboration and improved understanding of the role of skin exposures at work

The second keynote in Session 3 was Dr. Dhimiter Bello who spoke on "Models for predicting dermal exposure: development, validation and application." Dr. Bello first asked: "Why models?" Models help us understand relationships, investigate trends and make predictions in scenarios where measurements haven't been made (i.e., risk assessment).

When considering skin exposure, we can use models of airborne exposure as a starting point. The airborne exposure community has successfully collected extensive measurements and has compiled comprehensive datasets – both critical components of successful modeling. Dr. Bello also noted that it is critical to have a conceptual model and validation of the model. In the case of skin exposure modeling, we have few measurements, limited datasets and the relationships are poorly understood for the development of a conceptual model.

Dr. Bello highlighted the model of Schneider et al. (2000) and stated that although this model is complicated, it demonstrates that significant amounts of contextual information are also required. In addition to the contextual model, there are also many existing tools for modeling or predicting skin exposure. Dr. Bello singled out DREAM, or DeRmal Exposure Assessment Method, as a logical starting point for the next generation of modeling tools as we progress from source-receptor models to disease-process models.

The final keynote speaker for Session 3 was Dr. Wisnewski who gave a presentation titled: "Biomonitoring: promising targets for measurement in populations and individuals." Dr. Wisnewski first brought the audience up to speed with a brief review of biomarkers.

Biomarkers are internal measurements that account for exposure from all routes as well as PPE and individual differences. Biomarkers can be useful for acute and chronic monitoring as well as longitudinal analyses and even through biomarkers provide individual data, this data is useful for population studies. Next, Dr. Wisnewski reviewed the three types of biomarkers: biomarkers of exposure, biomarkers of effect, and biomarkers of susceptibility. Biomarkers are most useful when used in conjunction with other exposure information and can be used to evaluate interventions and control strategies.

Biomarkers can be measured in a variety of biological samples including hair, blood, urine, breath, and nails. The analysis of the biological samples is undertaken using a variety of analytical methods; the specific method will be specific to the exposure, the biological sample materials and the collection method.

Dr. Wisnewski presented the example of the Center for Disease Control's (CDC) National Biomonitoring Program which has been collecting data for over 10 years on hundreds of chemicals and also houses the National Health and Nutrition Examination Survey (NHANES) data.

There are also several indices to which biomarker measurements can be compared. The American Conference of Governmental Industrial Hygienists (ACGIH) publishes a list of Biological Exposure Indices, the BEIs. In addition, the Scientific Committee on Occupational Exposure Limits (SCOEL) published the Biological Limit Values (BLVs) and the German Research Foundation (DFG) publishes the Biological Tolerance Values (BTVs).

To help the audience understand the variety of biomarkers used in research, Dr. Wisnewski briefly summarized a series of examples from the literature. Dr. Wisnewski summarized important future directions including the use of signature peptides, colorimetric assays and furthering the development of a new area of immuno-hygiene research. In closing, Dr. Wisnewksi emphasized that ethics and worker rights should be considered carefully and continuously when embarking on biomonitoring for either research or in the workplace – a very important message indeed.

There were 21 poster presentations related to Sessions 2 and 3, covering a broad range of topics.

SESSION 4

Prevention of Occupational Skin Disease: Workplace Focus

The fourth session, chaired by Dhimiter Bello (USA) included a review of prevention strategies by Diane Llewellyn (UK) and evaluating proposed interventions by Linn Holness (Canada). These were followed by two parallel abstract driven sessions and eight posters covering topics in Sessions 4 and 5.

Dr. Llewellyn provided a review of prevention strategies. She started by reiterating the fact that OSD is common (second most common OD after MSK) and that contact dermatitis accounts for 70%-90% of all OSD and 20% were skin cancers. Most common allergens include: chromium and chromates, epoxies, nickel, plants, preservatives, resins and acrylates. Common irritants include: alcohols, cutting oils and coolants, degreasers, disinfectants, petroleum products, soaps and cleansers, solvents and wet work.

Dr. Llewellyn then reviewed the prevention strategies including elimination, substitution, engineering controls, administrative controls and PPE. Examples of substitution include chromates in cement substituted with ferrous sulphate, powdered latex gloves with non-powdered latex. Engineering controls may include automation and enclosure but the danger of exposure when cleaning and maintenance is required was stressed. Engineering controls can also include covers, screens and splashguards. Local exhaust may also be used. Administrative controls may include changing the way work is carried out to increase the working distance, job rotation or restricting access. PPE was noted to only offer protection if it is properly selected, worn correctly, removed and stored correctly and replaced or maintained regularly. While emollients have been demonstrated to have benefits, the same does not apply to pre-work (barrier) creams. She noted that it is hard to evaluate any one specific prevention strategy because they are often implemented as a package.

Dr. Llewellyn then tackled the perception of risk in the workplace. Safety issues are often seen as more important than health (disease) issues and risks to the skin are not always recognized. Views such as prevention is "common sense" or skin problems are "part of the job" were raised. Often PPE is seen as the only answer and its limitations are not well understood. Preventive measures may be seen as costly and impractical. Solutions include: raising awareness and understanding of risk, provide advice that is simple and sector specific and use communication channels that the sector trusts and listens to. She reviewed several different campaigns focused on prevention: Five Steps to "Cut Out Dermatitis"; Bad Hand Day campaign; It's in Your Hands; Healthy Skin @ Work and the importance of anecdotal evidence. She provided a number of sources of information including training tools and resources. Other ideas included the inclusion of skin prevention in national vocational qualifications and the development of standards of care for healthcare providers (Germany, UK-BOHRF). The British Occupational Hygiene Society (BOHS) has courses and exams on skin exposure at work. The key remaining questions include which educational interventions are the most effective and how to sustain campaigns to make them effective in the mid and long term.

Future considerations include: contribution of dermal exposure to systemic disease; skin exposures from newer technologies (nanotechnology, "green chemistry"); exploring beliefs and identifying challenges; and communication and education. Diane Llewellyn ended, as she started with a quote from Mark Boeniger "Occupational skin exposures will remain significant occurrences for some time because of the present lack of understanding among occupational health specialists about the risks".

Linn Holness (Canada) discussed "evaluating proposed interventions". This included an overview of evidence-based medicine and systematic review and guidelines, current reviews and guidelines related to OSD and finally a discussion of what were the next steps.

Evidence-based medicine (EBM) has its origins in the mid 19th century but re-surfaced in 1990's led by David Sackett and Gordon Guyatt from McMaster University. Sackett defined EBM as "the conscientious, explicit and judicious use of the current best evidence in making decisions about the care of the individual patient. It means integrating individual clinical expertise with the best available external clinical evidence from systematic research".

Following on overview of systematic review methodology and clinical practice guidelines, Dr. Holness noted that creating the evidence and guideline is the easy part, however, implementation into practice is more challenging and the evidence related to putting evidence into practice was reviewed.

Dr Holness reviewed the systematic reviews and guidelines applicable to OSD. These included reviews by Saary et al, the Cochrane review by Bauer et

al and the vanGils reviews. Each had a slightly different focus but the findings were similar. Finally, the guideline developed by Nicholson et al for the BOHRF was reviewed. In summary, there was some limited evidence for a variety of prevention practices but more high quality research is needed.

There was then an interactive discussion with the audience related to reviews and practice. Many of the participants felt there is a role for systematic reviews. An issue was raised, however, as to how to capture scenarios where an occupational hygienist goes into the workplace to assess the dermal hazard and develops recommendations to control the hazard which reduces workplace incidence of occupational contact dermatitis. These types of scenarios (case reports) do not qualify for systematic reviews. Dr. Diepgen suggested that this can be achieved through the development of industry guidelines.

Many agreed that more studies are needed and that field studies are the best approach to determine whether interventions are effective. Funding of these types of studies was cited as a challenge and if field studies are required, experts in the field need to agree that this is the preferred approach. Awareness campaigns (as per the German experience) were cited as having an impact on decision makers. The point was also made that intervention studies should follow a multidisciplinary approach including engineers who could provide input on how to change the process. From the clinical perspective, patch testing continues to be needed as a way of increasing awareness. Experimental data regarding personal protective equipment (PPE) was deemed necessary with guidelines needed to model experiments.

Discussion also focused on education of individuals who are "agents of change". The point was made that we actually have enough information to move forward and more studies are not necessarily required. The issue seems to be how to convince skeptics that prevention will have an effect. As simplistic as it seems, emphasizing that chemicals are harmful and that we can reduce exposure.

The session ended with the participants completing a short survey focusing on their interest in collaboration in work on primary prevention and their suggestions for the content for a short survey instrument.

SESSION 5

Prevention of Occupational and Environmental Skin Disease: Regulatory and Societal Focus

The fifth session, chaired by Irena Kudla (Canada) included jurisdictional updates from North America by Scott Dotson (USA), the European Union by Swen John (Germany), Australia by Rosemary Nixon, as well as brief overviews from conference participants from Japan, India, Singapore and South Africa.

Swen John (Germany) provided an update on the work of the European Union. There has been substantial progress with the founding of EPOS in 2009, the EADV campaign – "Healthy Skin @ Work", the Declaration of Dresden for Improved Standards of Prevention in Hairdressing adopted in 2010 by the EU and finally the WHO Global Workshop on OSD in Geneva in 2011. He then described several German initiatives focused on primary, secondary and tertiary prevention that demonstrated improved outcomes and financial savings.

Johan duPlessis and Frtiz Eloff provided an update from South Africa. There are two pieces of legislation related to OHS, one for general industry and one for mining. They noted there was little attention to skin exposures. They spoke about the Occupational Skin Disease Clinic at the National Institute of Occupational Health (NIOH) in Johannesburg and a Work and Health program that focused on pesticides in the agricultural sector and included skin exposure. They also noted the work in platinum mining including their research and education and awareness through the SAIOH.

The Australian experience was provided by Rosemary Nixon. SafeWork Australia is a Australian government statutory agency established in 2009 to improve occupational health and safety (OHS) and workers' compensation (WC) across Australia. It represents a partnership between governments, unions and industry. She outlined its functions and strategic plan. She also spoke of the GHS implementation. The states are responsible for OHS and WC and Dr Nixon noted the focus is on compensation.

Scott Dotson (USA) presented an overview of the North American

experience (with emphasis on the United States). He noted that the traditional focus has been on controlling airborne exposure with dermal exposure being a secondary pathway. In spite of this, he presented BLS (Bureau of Labour Statistics) data from 2008 which indicates that OSD is the largest category of non-fatal occupational disease (approximately 20%). Finally, he reviewed current work at NIOSH, ACGIH, AIHA and the EPA related to skin exposure and disease.

Dr. Goon reported from Singapore. He provided an overview of OHS legislation, currently the Workplace Safety and Health Act (2006). There is a joint occupational dermatoses clinic held monthly at the National Skin Centre.

Dr. Minamoto provided an update from Japan. Notably, OSD is not specifically included but would fall under diseases due to chemical factors in the official list of occupational diseases (that can be compensated). She presented claims data for OSD, criteria for sensitizers and the Japanese guidelines for the treatment of contact dermatitis.

Participants' Recommendations

Strategies for Future Work: A Decade of Progress, a Decade of Promise

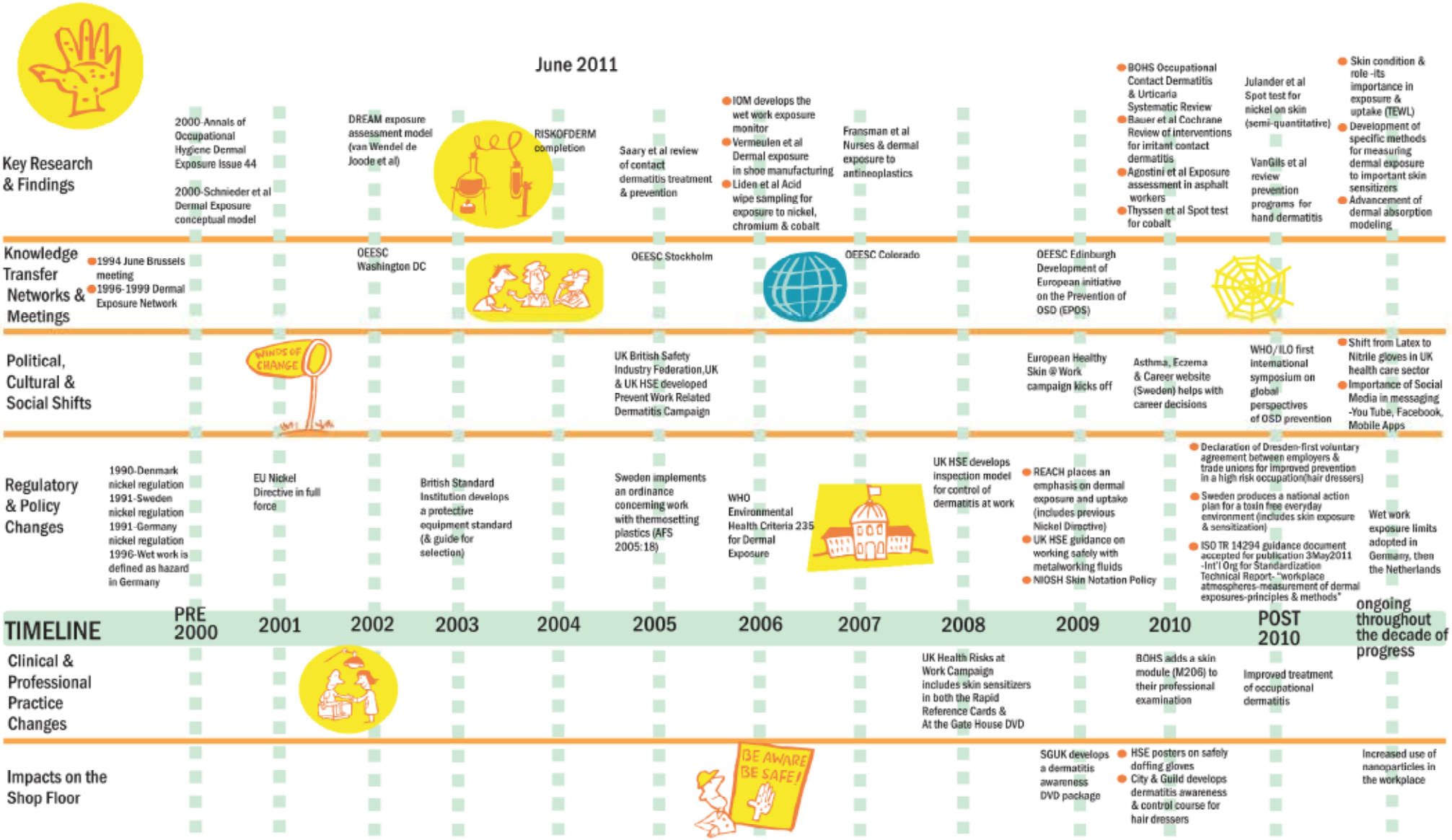
Fulfilling the "Decade of Promise"

Strategies for Raising Awareness: Should We Use Positive or Negative Images?

Participant Interests & Survey Feedback

OEESC 2001-2011 - A DECADE OF PROGRESS

An interactive poster session was held throughout the conference to capture specific research achievements related to occupational and environmental exposure of skin to chemicals. Attendees posted the following observations as a foundation for future work:



OEESC 2011-2021 - A DECADE OF PROMISE

A second interactive poster session was held throughout the conference to capture KT ideas for the future. Attendees posted the following suggestions:

GROWING KNOWLEDGE
...on Occupational Skin Disease, Exposure & Prevention.

DEVELOP KNOWLEDGE

Approach to Research

-define research agenda

-increase multidisciplinary & collabrative studies

-standardize methods & protocols with provision for application in workplace settings where control of the environment may not be possible

Topics for Research

-burden of disease including under-reporting & determination of work relatedness

-barrier function including effects of personal & environmental factors & effects on allergic & irritant dermatitis

-prevention-both skin specific & general prevention strategies & evaluation in workplace studies

-routes of sensitization-dermal & inhalation exposures & outcomes

-modelling-skin response model, absorbption -DTK model

TRANSFER KNOWLEDGE

Transfer Knowledge

-continue work on effective knowledge translation methods to identify effective implementation strategies in the workplace

-develop & disseminate targeted, simple communications, education & training resources

-explore & utilize social media & other technology developments

-share & disseminate workplace experiences-both good & bad

Networks

-create I-POS

-start website

-build on existing campaigns, ensure materials are available for broad use

-explore ways to collect & pool data

Meetings

-encourage conference & meeting attendance from a broad range of participants-researchers, practitioners, policy & regulatory to enable scientific advances to be translated into practical prevention measures in the workplace

-consider focused workshops on specific topics of interest-separate or in conjunction with larger meetings

APPLY & ASSESS KNOWLEDGE

Putting Knowledge into Practice and Assessing Outcomes & Evidence

Workers and Workplaces

-include information on skin exposure, effects & prevention in vocational training programs

-promote the utilization of resources to increase awareness & provide information in workplaces

-promote broad workplace strategies to improve overall health & safety in workplaces

-make available easily accessible resources in multiple languages

-educate workers & implement simple assessment tools to measure glove breakthrough, skin contamination & surface contamination

-incorporate skin exposure control into ISO processes

Practitioners

-include occupational content in health professional training

-improve training related to skin exposure & prevention in educational programs for industrial hygienists & safety professionals

-improve training related to occupational exposures & diseases, its diagnosis & management for dermatologists & occupational medicine physicians

-improve the access to specialized diagnostic centres & resources

Policy, Regulatory, Societal

-better understand the regulatory process to more effectively advocate for change

-advocate for policy & regulations related to dermal exposure

-learn from jurisdictions that have been successful in implementing policy & regulations

-raise awareness of occupational skin disease & exposure, build case for change

-engage unions, employer associations & other relevant parties to build coalitions for advocacy

-consider ethical impact of genetics, biomarkers & biomonitering & need for appropriate policy or regulatory action

-consider banning or strict controls on highly sensitizing substances-using examples of leading jurisdictions- nickel, chromium, PPD

-promote broad societal campaigns related to skin exposures & disease

Fulfilling the "Decade of Promise"

This session was an interactive discussion chaired by Dr. Linn Holness (Canada) in attempt to unearth the key research questions and collaborative work for the next decade. This discussion built upon the Decade of Progress, Decade of Promise theme of the conference.

The primary areas of need highlighted by the group included:

1. Multidisciplinary approach
2. Development of an approach for "globalization" regarding skin awareness and workplace factors
3. Continued lobbying of politicians
4. Improved understanding of the issue including burden and how to determine work relatedness
5. Development approaches targeted to industries at particular risk (small business)
6. Continued development of evidence-based guidelines
7. Knowledge translation
8. Importance of data collection and notification/reporting
9. Improved prevention – elimination, technical measures, work organization, personal protection, pre-employment screening
10. Improved understanding of allergic versus irritant.
11. Improved access to patch testing
12. Enhanced education of dermatologists and physicians generally regarding work-related skin disease
13. Further work on systemic effects/ toxicity of skin exposures

Key specific topics for further focus and study included:

- Protective equipment – comprehensive measures
- Hand eczema
- Dermal exposure to metals
- Substance containment level
- Understanding exposure routes
- Establish significance of dermal exposure as equal to respiratory exposure
- Establish occupational hygiene as a priority re: dermal exposure
- Skin cancer
- Vulnerable populations e.g., recent immigrants
- Risky jobs e.g., construction, janitorial, wet work
- "Outside to inside"
- Develop organizational measures
- Improve surveillance
- Modeling dermal penetration and systemic toxicity
- Wet work and irritant contact dermatitis
- Work supporting increased understanding of systemic toxicity of dermal exposures (dermal penetration; modeling of occupationally relevant exposure; modeling needs to be accessible (e.g., web-based tools)

Ideas for moving ahead included:

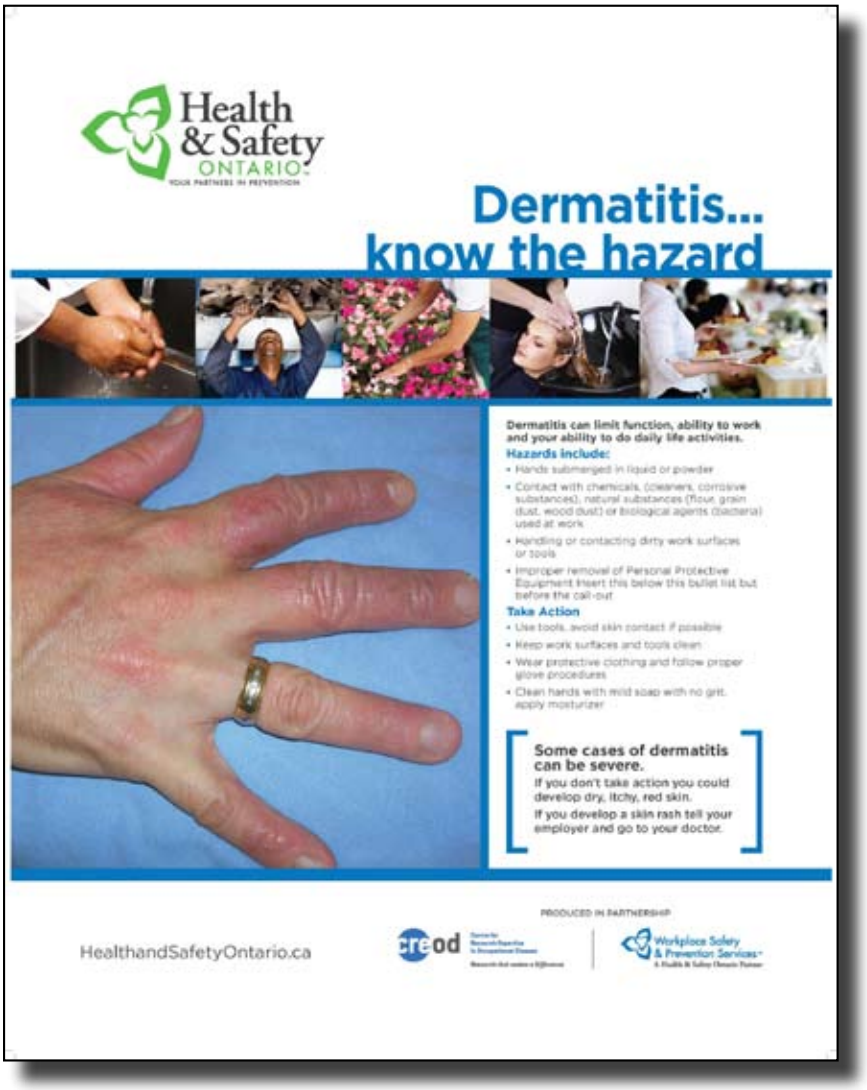
- Develop ways to better collaborate e.g., how to measure biologically relevant exposures including a common measurement scheme and increase connection between measurement and modeling; use same indices and assessment instruments
- Address change in policy and regulatory change by working together to strengthen the message
- Build on success in primary prevention e.g., substitutions, engineering controls
- Share what we know about risk e.g., agents and occupations
- Improve the number of high quality studies
- Build interdisciplinary efforts
- Improve integration e.g., evidence, clinician/professional practice and experience, worker/workplace context knowledge
- Learn more about environmental factors to stimulate/model experiments by going to workplaces and learning; contact is the issue with engineers, managers and workers – need to get together and sort out controls
- Ask clinics to collect information about workplaces from patients
- Improve KT – awareness campaigns, stories, training, resources; develop an intervention study together to improve prevention e.g. nickel: lots of information exists – we need to sort out how to disseminate
- Better understand costs – medical, direct non-medical, indirect non-medical
- Develop the field of occupational hygiene with regards to skin exposure in North America
- Need more primary prevention studies; field studies
- Need one place where information about new knowledge and guidelines are available in addition to publications – develop evidence base together – more powerful
- Increase fees for dermatologists to do patch testing
- Publish together looking at differences across jurisdictions
- Develop a coordinated effort (exposure limits, controls, sampling and analytical methods) looking at dermal exposures as has been done with inhalation including:
  - Methods to characterize dermal exposures
  - Public health surveillance
  - Risk assessment methods
  - Control methods and risk management practices

STRATEGIES FOR RAISING AWARENESS: SHOULD WE USE POSITIVE OR NEGATIVE IMAGES?

Another interactive activity during the conference was the presentation of two options for posters designed to raise awareness of occupational skin disease for use in industry. This work is being done by CREOD and Workplace Safety and Prevention Services, a health and safety organization in the Province of Ontario.

Two posters were developed: one with a positive approach and one with a negative approach. Conference participants were asked to "vote" on their preferred poster. The posters had also been presented at a large health and safety conference where a similar voting process was used.

Option 1: Negative Imagery – 19 Votes



"People don't think of the severe kind of dermatitis that is seen in occupational dermatology when you say 'dermatitis.' Healthy skin campaigns are ubiquitous, especially regarding sun exposure, but we know people don't respond to that, people don't wear sunscreen as often as they should. While option 2 is more attractive, option 1 is more likely to raise awareness, especially with the banner of different workplace scenarios on top of the poster and not on the bottom"

"Layout of option 1 would be more effective if the same as option 2 – bigger picture of hand, has white space"

"The photograph in option 1 is much more relevant"

"No. 1 looks like you don't want to look to close"

"Option 1 appeals to men"

"Connects rash/skin reaction to dermatitis and workplace hazards"

"Makes it clear what the problem is – people could say 'my hands look like that.'"

"Feel clients – manufacturing would find number 2 too touchy feely"

"Option 1 tells you more immediately it is about skin and hand hazard"

"1 is more graphic"

"1 gives worker detailed information – doesn't necessarily require the employer to have this information/disseminate it"

Option 2: Positive poster – 20 votes

"More attractive and will appeal to people. Why not combine 1 and 2 by including a (small) picture of the hand of #1 and the warning box (the one in blue brackets) so you'll have an attractive poster with also an emphasis on the hazard"

"Preferred as it is a vehicle for communicating to those who do not yet have an occupational skin condition re: the value of prevention. Individuals with no current skin condition or disease may not perceive number 1 as applying to them"

"Option 2 was more visually appealing and causes one to think of the impact of an occupational skin condition on their professional/work and personal lives

"Option 2 is warmer and more attractive to the eye, more like a horror movie"

"Talk more about what/how to do instead of what to avoid in a more positive way"

"Use both options – Option 2 appeals to women"

"Better – it focuses more on health, option 1 focuses more on disease"

"Appeals to a broad life experience and potential consequence"

"Doesn't build on the scary effect like option 1. More positive outlook on skin care"

"More appealing image"

"Image is more appealing – resonates with women"

"Grabs your attention and holds it. If you had dermatitis or knew someone that did, #1 may resonate. The most important thing is to have an image that stands out and is remembered to draw people back or incite them to read the message and learn more"

"Emphasize the positive – research shows this – skin hydration"

"May be more effective if it was a picture with a rash or dermatitis on the face or hands that were affected holding a baby to get at the quality of life perspective and how it impacts the individual and others"

PARTICIPANT INTERESTS AND SURVEY FEEDBACK

Another interactive activity was the completion of a survey designed to identify participants' interest in participating in data gathering activities and also suggestions for key prevention questions to be included in surveys.

Fifty two participants completed the survey. The results are as follows:

Respondents' Focus:

Research – 44%, Workplace – 42%, Clinical – 38%, Policy – 19%

Willing to Collaborate – 75%

Percent of respondents who agreed that the following should be included in questionnaires:

Training in general OHS as required by jurisdictional legislation – 56%

Training in chemical hazards as required by jurisdictional legislation – 63%

Training in general skin exposure prevention and protection – 73%

Whether a skin management program/policy is in place in workplace – 56%

Whether worker is familiar with concept of "safe working distance" – 48%

Training in use of PPE – 71%

Training is skin care practices (hand washing, creams) – 67%

Training on early signs of dermatitis – 69%

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