



Occupational Hand Dermatitis in Health Care: Development and Evaluation of an Online Training E-Module

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Abstract: Background: Occupational hand dermatitis (OHD) is an important health concern for health care workers (HCWs), yet there is a lack of accessible training materials on this topic.

Objectives: The objective of this study was to develop and evaluate an OHD training e-module for HCWs.

Methods: The e-module was created in collaboration with an expert advisory committee and tested by Ontario HCWs through pre- and post-training OHD knowledge tests, a usability survey, and a survey about intent to change work skin care practices. Analyses of survey results included means and paired *t*-tests.

Results: The 10-minute OHD training e-module for HCWs was tested by 254 HCWs and found to be highly usable, to increase OHD knowledge immediately and sustainably, and to change workplace skin care practices. Average OHD knowledge test scores significantly improved by 19% between the pretest (64.50%) and post-test (83.50%). Most 6-month follow-up survey respondents reported changing their skin care work practices (76.69%).

Conclusions: This research addresses the previous lack of accessible OHD training for workers in health care settings. The creation and evaluation of a no-cost accessible OHD training e-module for workers in health care settings showed promising results across knowledge increase, knowledge retention, skin care behavior changes, and usability.

Capsule Summary

- The objective of this study was to develop and evaluate an occupational hand dermatitis (OHD) training e-module for workers in health care settings.

- The training-module was found to be highly usable, to increase OHD knowledge immediately and sustainably, and to change workplace skin care practices for workers in health care settings.
- The evaluated 10-minute training e-module is available publicly at no cost in French and English.

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BACKGROUND

Occupational hand dermatitis (OHD) is one of the most common occupational diseases in the general population with prevalence rates of 2–15%,¹ but prevalence of OHD is even higher for health care workers (HCWs) (21–30%).^{2,3} A likely contributor to the higher prevalence of OHD for HCWs is the substantial amount of wet work that is required in HCW jobs; past research has found that wet work contributes to the development of OHD.⁴ Wet work is having one's hands in liquids for >2 hours per shift, wearing occlusive gloves for >2 hours per shift, or washing hands >20 times a shift—all of which are common practice for many HCWs.⁵ Furthermore, wet work in health care settings has increased throughout the current SARS-CoV-19 pandemic as a result of increased health and safety precautions; therefore, OHD prevention and treatment for HCWs is of increased importance.

OHD can have serious consequences for the worker, employer, patient, and society. In addition to any change in HCWs' quality

of life as a result of pain and difficulty completing regular daily tasks, workers may also experience extended sick leave, disability status, job loss/unemployment, change in occupation, and/or a change in their ability to complete certain work tasks.^{6–10} Such outcomes not only affect the worker directly, but also contribute to human resource challenges for their employers and can reduce access to care. Patients of HCWs who continue to work with OHD can experience negative outcomes as well, with some evidence linking infection from OHD in HCWs to patient infection.^{11,12}

In addition, there are societal costs for workers with OHD as a result of sick leave or permanent disability, which range from \$4,984 to \$115,209 per person¹³; equating to substantial total societal costs, with estimates of \$1.4 billion per year in Canada.¹⁴ As HCWs have a relatively high prevalence of OHD, focusing on this occupational group is particularly relevant. Preventing OHD in HCWs is beneficial for HCWs, patients, employers, and in reducing costs to workers' compensation and health care systems.

Although a number of training programs have been developed and evaluated in Europe, there is limited information about their general use, particularly in the North American context. Studies from Ontario, Canada have documented gaps in workplace training regarding skin exposures and prevention training.^{15–17} In Ontario, 1 study reported that in a sample of Ontario workers, the majority (69%) were exposed to wet work, whereas less than half (39%) received skin-specific training.¹⁷ For HCWs, Ontario occupational health nurses reported that OHD training resources were sparse, that what was available concentrated mostly on hand hygiene, and suggested that online educational resources would be beneficial.¹⁸

Furthermore, Public Health Ontario (PHO) conducted an environmental scan of occupational health and infection prevention control in the health care sector and found that OHD was a key concern and that more education in general and more options for teaching materials were required.¹⁹ Improving education and training programs would be of value for HCWs, as systematic reviews have found that education and training programs are effective at reducing occupational disease.^{20,21} In summary, OHD has been highlighted as an important health concern for HCWs, evidence suggests that training is effective in reducing occupational disease, and the need for more training and educational materials specific to HCWs has been identified. With respect to the most appropriate type of training, the most effective teaching tools for OHD are industry specific, have participatory elements, include multimodal learning, and offer skin care resources.²²

Objectives

This study directly addressed previous reports of inadequate OHD training for HCWs in Ontario through the creation and evaluation of a no-cost accessible training e-module for HCWs. Specifically, the objectives of this study were to (a) develop a 10-minute online training e-module for HCWs about prevention, early identification, and management of occupational hand der-

matitis (OHD), including self-screening for disease; and (b) evaluate the usability of the e-learning module and the impact of training and self-screening on knowledge and hand health practices in HCWs in Ontario.

METHODS

The study consisted of several phases for the course of ~2 years, from January 2020 to March 2022. The study was approved by the University of Toronto Research Ethics Board (RIS Human Protocol Number 38405).

Training e-module creation

A no-cost online training format was chosen to enable widespread uptake given that multiple studies have reported a lack of OHD training for HCWs in Ontario, the increasingly common virtual work aspects with more flexible and remote workplaces, and the cost of purchasing education materials as a potential barrier to uptake (particularly for small employers that may have fewer financial resources).

The training content was created with input from our expert advisory committee. This consisted of multiple in-person and virtual meetings and e-mail communications about the material for the training. Participating organizations included member(s) from the Centre for Research Expertise in Occupational Disease (CREOD), Ontario Occupational Health Nurses Association (OOHNA), Ontario Public Services Employees Union (OPSEU), Public Services Health and Safety Association (PSHSA), PHO, and VHA Home HealthCare. PSHSA was responsible for creating the e-module based on content generated by the full advisory committee, which reviewed the e-module before the evaluation phase.

Training E-Module Evaluation

Workers employed in health care settings in Ontario at the time of the study were invited to participate. Participants were recruited through multiple means, including through advisory committee member organizations' newsletters, journals, posters, and e-mails to employees and through promotion of the study in HCW-targeted print and social media from November 2021 to July 2022. Participants completed consent forms before participating and were compensated with a \$20 gift card for their participation in the first phase of the study and a second \$20 gift card was provided to those who completed the 6-month follow-up survey.

In the first phase of the study, participants completed a knowledge test about OHD pre- and post-training to evaluate changes in OHD knowledge. A usability survey was delivered at the end of the training to measure the appropriateness of the e-module format, including questions about information relevancy, clear and logical arrangement of information, time to complete, likelihood of recommending to a colleague, amount of detail, overall visual design, and smooth functionality. Study

participants were asked questions about whether they had intention to change (start, stop, or change) skin care practices based on the training. The knowledge test, usability survey, and intention to change questions are available on request.

In the second phase of the study, participants were recontacted through e-mail 6 months after they completed the first phase to invite them to participate in the follow-up survey, which included the knowledge test and practice change survey items.

Descriptive statistics were generated to describe the sample, average knowledge test scores, usability ratings, intention to change skin care practices, and actual changes in skin care practices in terms of means and proportions. Paired *t*-tests were utilized to assess the significance of any changes in each participant's pre- versus post-training OHD knowledge test scores, as well as the significance of any changes between the pretraining knowledge test score and the 6-month follow-up knowledge test score. In addition, qualitative summaries were created of open-text comments on the surveys about usability, intent to change behavior, and changes in skin care practices 6 months after training.

Finalization of Training E-Module

After the analysis of phase 1 data, the advisory committee reviewed responses and made changes required to finalize the training e-module based on study participant feedback. Once finalized, the training e-module was made publicly available on the CREOD website in both English and French, and can be accessed here (<https://creod.on.ca/SkinDiseasePreventionEN/story.html>). The training e-module covered topics that included an introduction to hand dermatitis, defining irritant and allergic contact dermatitis, specific skin hazards in health care workplaces, skin care practices for dermatitis prevention, and early detection including a quick self-screen.

RESULTS

Study participants consisted of employees in Ontario health care settings ($n=254$) who completed the training and corresponding pre- and post-training surveys. Study participant's employment characteristics are summarized in Table 1.

Knowledge Scores

After completing the training e-module, average knowledge scores significantly improved by 19.0% (95% confidence interval; CI [16.0–22.1]) between the pretest ($M=64.5\%$, $SD=25.4$) and post-test ($M=83.5\%$, $SD=13.0$). There were significant improvements in OHD knowledge test scores after completing the training as demonstrated through paired *t*-test results [$t(253)=12.3$, $P<0.001$].

The 6-month follow-up survey had a 57% response rate ($n=144/254$). Participants at follow-up did not significantly differ by occupation, position type (eg, full time), number of employers, or health care sector from the initial sample. In the 6-month

TABLE 1. Self-Reported Characteristics of Survey Participants Who Completed the Training

	Total Sample (N = 254), n (%)
Occupation	
Nursing	79 (31.1)
Allied HCWs ^a	66 (26.0)
PSWs ^b	58 (22.8)
Physicians	6 (2.4)
Service workers ^c	4 (1.6)
Other	39 (15.4)
Nonresponse	2 (0.8)
Employment positions	
Full time	172 (68)
Part time	58 (23)
Casual	4 (2)
Other	18 (7)
Nonresponse	2 (0.8)
Number of employers	
1	192 (75.6)
2	36 (14.2)
Self-employed	24 (9.4)
Nonresponse	2 (0.8)
Health care sector ^d	
Community	98 (38.6)
Hospital	84 (33.1)
Home	74 (29.1)
Long-term care homes	44 (17.3)
Other settings (eg, public health)	19 (7.5)

^aAllied HCWs typically include rehabilitation professionals such as occupational and physical therapists.

^bPSWs are unregulated providers who assist with activities of daily living (alternative titles include Health Care Aides and Direct Care Workers).

^cService workers in health care settings may assist with food or cleaning services.

^dNote that participants could select more than 1 health care sector. HCWs, health care workers; PSWs, personal support workers.

follow-up knowledge test ($M=74.8\%$, $SD=15.6$), participants scored higher than they did in the pretraining test ($M=64.5\%$, $SD=25.4$). This average improvement of 10.3%, 95% CI [5.4–15.1] between pretraining knowledge scores and the 6-month follow-up was statistically significant by respondent (paired *t*-test) [$t(132)=4.2$, $P<0.001$].

Behavior Change

Table 2 outlines the participant responses for intention to modify any skin care practices at work immediately after completing the training as well as any real behavior changes that were reported in the 6-month follow-up after completing the training. The majority of participants intended to modify at least 1 aspect of their behavior related to skin care practices at work (72.8%, $n=185$) and most of the 6-month follow-up survey participants reported success in making a real change (70.8%, $n=102$).

Hand care habits such as moisturizing and hand washing were the top practices that participants intended to start, stop, or

TABLE 2. Workplace Skin Care Practice Intended and Actual Modification

	n (%)
Post-training intention to modify practice	
Intent to modify any workplace skin care practice	n = 254
Yes	185 (72.8)
No	34 (13.4)
Nonresponse	35 (13.8)
Intent to start a new workplace skin care practice	183 (72.1)
Top practices intending to start	n = 183
Skin care habits (eg, moisturizing)	77 (42.1)
Early detection (eg, self-screening)	69 (37.7)
Other	37 (20.2)
Intent to stop a workplace skin care practice	163 (64.2)
Top practices intending to stop	n = 163
Hand hygiene habits (eg, excessive hand washing)	71 (43.6)
PPE (eg, wearing gloves too long)	42 (25.8)
Other	50 (30.7)
Intent to change a workplace skin care practice	177 (69.7)
Top practices intending to change	n = 177
Skin care habits (eg, moisturizing)	81 (45.8)
Heightened attention to wet work	28 (15.8)
Other	68 (38.4)
6-Month follow-up reported practice modification	
Reported any skin care practice modification at 6 months	n = 144
Yes	102 (70.8)
No	31 (21.5)
Nonresponse	11 (7.6)
Successfully started new skin care practice as intended	n = 99
Yes	79 (79.8)
No	20 (11.2)
Successfully stopped new skin care practice as intended	n = 84
Yes	64 (76.2)
No	20 (14.8)
Successfully changed skin care practice as intended	n = 96
Yes	73 (76.0)
No	23 (24.0)
Reason for reporting no skin care practice changes	n = 27
Nothing to improve	15 (55.6)
Changes not possible or practical	8 (29.6)
Forgetting to make a change	2 (7.4)
Not wanting to change	2 (7.4)

PPE, personal protective equipment.

change. More than 3-quarters of the 6-month follow-up survey participants who had intended to start, stop, or change a behavior immediately after the training were successful in doing so (79.8%, $n = 79$; 76.2%, $n = 64$; and 76.0%, $n = 73$, respectively). More than half of the participants (55.6%, $n = 15$) who did not modify their behavior at 6 months commented that they already had good skin care practices, whereas changes were not perceived to be practical by approximately one-third (29.6%, $n = 8$) of participants.

TABLE 3. Usability Survey Results

Usability Statement	Proportion Reporting "Strongly Agree" or "Agree," n (%)
The e-module subject matter was relevant to me.	248 (97.6)
The content was arranged in a clear and logical way.	252 (99.2)
The amount of time it took to complete this e-module was reasonable and appropriate.	248 (97.6)
Based on my experience with this e-module, I would recommend it to a coworker.	247 (97.2)
The content of the e-module had the right amount of detail.	246 (96.9)
The overall visual design (text and font legibility, use of photos and diagrams, and narration) was appropriate.	247 (97.2)
The e-module functioned smoothly (easy to navigate, interactive features worked, and links to resources worked).	243 (95.7)

Usability

Usability survey results were highly positive, with >95% of participants agreeing or strongly agreeing on a 5-point Likert scale (from strongly agree to strongly disagree) with positively framed statements as listed in Table 3. Given the encouraging response to the training e-module usability, few changes were made by the advisory committee before finalizing the e-module.

The usability survey included an open-text option for participants to provide additional feedback. We received open-text responses in 5.3% of the possible sections (83 responses out of the possible 1575 open-text opportunities throughout the survey for the entire sample). Most of the written feedback was positive (70.0%, $n = 58$), whereas the few remaining comments focused on wanting more prevention and treatment information (12.0%, $n = 10$), issues with functionality (10.0%, $n = 8$), and miscellaneous comments (8.0%, $n = 7$). Based on this open-text feedback, 1 major change that was made for the finalized e-module was improving the diversity of skin color in the photo examples of OHD.

DISCUSSION

Overall, the evaluation showed that the training was successful in improving OHD knowledge, knowledge retention, usability, and skin care practice changes across a sample spanning several HCWs groups and multiple health care settings in Ontario. This research showed that the creation of occupational health training that is based on content expert input, directed at a specific workplace, and presented in a highly usable format, is effective in advancing occupational health knowledge and practice change.

Previous studies have found that HCWs' knowledge of OHD was limited, contributing to OHD cases that could have been prevented or reduced in severity.^{15–17,20,21} Results from this study confirmed gaps in OHD knowledge among participating HCWs, and indicated that the type of education training developed here was effective at increasing HCWs' knowledge of OHD in a sustained manner.

Despite the intervention consisting of only a 10-minute training e-module, 72% of participants expressed an intention to change and the majority (77%) of participants in the 6-month follow-up survey had changed at least 1 aspect of their skin care practices in the 6 months post-training. Although we did have a fairly high response rate in the follow-up surveys (57%), selection bias could have resulted in higher likelihood of retaining for the 6-month follow-up those who were more interested in skin care practice changes than those who were not, leading to overrepresentation of those who had made practice changes. Even if this is the case, we still find that at least 40% of the original participants reported changes to their skin care practices 6 months after e-module completion, which is a relatively strong impact on behavior from a 10-minute training e-module.

For those reporting no change in their skin care practices, the major reason provided was that they already practiced healthy skin care practices. However, one-third of those who did not make any changes did not think that it was possible or practical to do so in their workplace. This emphasizes a need for employers to work with workers to ensure that healthy skin care practices are possible (and are known to be possible) for all workers across all health care environments.

Given the limited number of open-text comments about e-module usability focused on wanting more information ($n=10$ comments) and issues of functionality ($n=8$ comments) compared with the overwhelmingly positive responses in usability rating scores (where >95% strongly agreed or agreed with all usability statements), no changes were made related to usability between the tested and finalized versions of the e-module. Additional feedback was that some ($n=10$) asked for more information. We balanced this feedback with the desire to limit the training to 10 minutes by including weblinks to additional materials with further information about these topics at the end of the e-module. The major change made for the finalized version was to add more photo examples of how OHD presents on the hands of people of color. We would like to note that obtaining these images was difficult, reinforcing that the availability of images of dermatitis as experienced by people of color is an area to be improved on in the future.²³

The highly collaborative approach to creating this training e-module, which included diverse expert advisory members to support content creation, experienced designers for health care e-modules to create effective and engaging content, and the brevity and online format of the training, was effective at producing a highly usable training e-module, based on participant feedback. Future training creation should consider such factors in designing highly usable training products to improve health-related knowledge and influence behavior change.

Limitations

This study is based on surveys of Ontario HCWs. Although inclusion criteria were broad, Service Workers and Physicians were under-represented in the sample, limiting our understanding of the impact of training for these groups. As with any survey-based study, there is the potential for selection bias for the study as a whole and particularly for the 6-month follow-up survey, as individuals more interested in making skin care practice changes may have been more likely to respond, and more likely to provide open-text responses. Similarly, participants' reporting of their behavior change intent and practice may be subject to social desirability reporting bias, which could lead to inflated reports of changes to workplace behaviors.

CONCLUSION

This research addresses the previous reports of a lack of accessible OHD training for workers in health care settings to mitigate the high prevalence of OHD in health care occupational settings. A major output from this research is the evaluated 10-minute OHD training e-module for HCWs in French and English, currently publicly available at no cost. This training was found to be highly usable, to increase OHD knowledge immediately and over time, and to change workplace skin care practices across a sample of frontline workers in various health care settings. Given the success of this training, both utilizing this existing training and using a similar process for developing additional educational materials would be of high value to improve knowledge and lead to real behavior change, with the ultimate goal of reducing and preventing occupational health diseases.

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