

ORIGINAL ARTICLE

Screening for hand dermatitis in healthcare workers: Comparing workplace screening with dermatologist photo screening

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Background: Healthcare workers are at increased risk for occupational contact dermatitis, owing to wet work exposure. Early detection and management improves outcomes. Although several diagnostic tools are available, none is appropriate for rapid screening.

Objectives: To assess the validity and feasibility of the Hand Dermatitis Screening Tool in the acute healthcare sector.

Methods: Screening of 508 employees at three hospitals in Ontario, Canada was performed with the Hand Dermatitis Screening Tool either by an occupational health nurse ($N = 225$) or by self-administration ($N = 283$). Two occupational dermatologists rated photographs of participants' hands.

Results: Of the participants, 30.5% screened positive for hand dermatitis. A positive screen was associated with wet work, history of eczema, dermatitis, or other rash, and currently having a rash. Ninety-four per cent of participants reported that using the tool took <2 minutes, 99% indicated that the tool was easy to use, and 86% stated that workplace screening was very important. Workplace and dermatologist photo screening showed fair agreement.

Conclusions: The prevalence of hand dermatitis and identified risk factors were consistent with the literature. These findings, along with positive feasibility results, support further testing of the tool despite only fair agreement between workplace and dermatologist screening.

KEYWORDS

occupational contact dermatitis, wet work, workplace screening, occupational disease, healthcare workers, hand dermatitis, acute healthcare sector, prevention, RRID:SCR_001905

1 | INTRODUCTION

Occupational contact dermatitis (OCD), both irritant and allergic, is common in healthcare workers (HCWs).¹ A key risk factor for irritant contact dermatitis for HCWs is exposure to wet work.² Wet work has been defined as any tasks that include frequent hand washing, handling of wet items, wearing gloves or other occlusive protective clothing, or using alcohol-based hand sanitizers.³ The prevalence of OCD in the general population ranges from 2% to 15%,^{4–6} whereas the

prevalence in HCWs has been reported to be approximately 21% to 30%.^{7–9} In addition, OCD may have significant impacts on the worker, workplace, and society.^{10–18}

Primary prevention of OCD involves reduction of exposure, appropriate skin care, personal protective equipment, and training.¹⁹ Despite the proven effectiveness of prevention programmes,^{1,20} gaps in prevention practices still exist.^{21–23} Workers with exposure to wet work are less likely to have received training, provision of personal protective equipment, moisturizers and barrier creams and warning

labels than workers with exposure to other occupational skin hazards.^{21–25} In the healthcare sector, hand washing and equipment and environmental cleaning are strongly encouraged, and, more recently, because of enhanced concern regarding infectious disease transmission, closely monitored and often audited.

Secondary prevention is focused on early detection of skin changes before they become permanent and disabling. There is evidence that the longer the time that passes between the onset of symptoms in a worker, and diagnosis and treatment, the poorer the outcome. Hence, early detection of disease is warranted.^{20,26} Although Emmett²⁷ suggested the potential advantages of screening in the context of OCD, little has been done in this regard apart from including recommendations for surveillance and screening in guidelines.¹ For example, the Health and Safety Executive in Great Britain currently outlines standards for high-level and low-level skin surveillance, with the difference being visual inspection by a “responsible person” and the need to establish a baseline soon after a worker commences a post.²⁸ Although there are several studies from Europe examining secondary prevention programmes in HCWs, cleaning workers, and kitchen workers, the focus of these studies was on treatment, not on the initial identification of those who participate in the programme.^{29–32} Established diagnostic tools for assessing the severity of dermatitis are available, but most are not designed as measures for brief screening.³³ Many existing dermatitis screening tools are extensive and burdensome for staff and patients; for example, the Nordic Occupational Skin Questionnaire long version consists of a 19-page assessment, whereas the short version consists of a 4-page assessment.⁶

We have developed and tested a rapid workplace screening tool called the Hand Dermatitis Screening Tool for use in the healthcare sector.^{3,34,35} The studies confirmed a high prevalence of hand dermatitis in HCWs, and associations with wet work and a history of dermatitis, and the tool had positive feasibility results. These positive results supported the performance of a larger, more comprehensive study. The purpose of the present study was to assess the validity of the Hand Dermatitis Screening Tool in the acute healthcare sector, and to assess the feasibility of implementing workplace screening for OCD in hospital workers who are at high risk for exposure to wet work. Validity testing focused on the sensitivity of the tool by comparing workplace screening (self-screening and nurse screening) results with occupational dermatologist screening results.

2 | METHODS

This was a cross-sectional study implemented in two phases and carried out in three different acute healthcare organizations within the Greater Toronto Area in Ontario, Canada. Institutional and ethics approval was obtained from the administering and participating sites. Sample size calculations for agreement between ratings were conducted on the basis of previous research describing OCD prevalence.³

In the first phase, workplace screening for hand dermatitis was completed at all three hospitals with the Hand Dermatitis Screening Tool developed by Nichol et al.^{3,35} The tool is a one-page, double-sided instrument consisting of five sections: (a) demographics and

workplace characteristics (six items); (b) current exposures to wet work, frequency of hand washing, and protective glove use practices (five items); (c) history of skin conditions (four items); (d) screening results (one item); and (e) feasibility evaluation (three items). Screening results (section 4) included the following three categories: (a) normal (clear skin, no redness, and no dryness); (b) mild (small areas of the hands have slight redness and/or dryness); and (c) moderate/severe (large areas of the hands have slight redness and/or dryness, or small areas of the hands have severe redness and/or dryness, or areas of the hands have severe redness, dryness, scaling, fissures, crusts or scabs, vesicles, and/or papules).

There were two methods of tool administration: screening by an occupational health nurse (OHN) and self-screening. The term OHN in this article is used to include Registered Nurses who work in the Occupational Health Clinic who may or may not be certified in occupational health nursing as outlined by the Canadian Nurses Association. With the first method, hospital employees visiting the Occupational Health Clinic for any purpose were invited to participate in the study by an OHN at the end of their visit. Participants completed the first three sections of the tool, and the OHN then conducted the screening, answered the feasibility questions, and noted on the screening tool whether the reason for the participants' visit included a concern about hand dermatitis, to ensure accurate calculation of prevalence. Those who visited the clinic because of concern about hand dermatitis were excluded from the analyses. With the second method, a Research Assistant recruited participants from patient care units during regular work hours. The Research Assistant introduced the study and completed the consent process for those interested in participating, and the participant then completed the questionnaire, self-screened for the presence of hand dermatitis, and answered the feasibility questions.

In both methods of administration, a photo guide was provided to aid the OHN or participants in determining the appropriate screening classification of hand dermatitis. The photo guide used was the same as the one used by Nichol et al.³⁵ Immediately after screening, the Research Assistant took two sets of ventral and dorsal photographs of all of the participants' hands by using a Canon PowerShot SX700 HS digital camera. A white background was used for all photographs. All participants received an information sheet on occupational skin disease, and those who screened positive were given a site-specific medical follow-up form and were encouraged to seek medical follow-up.

The second phase of the study included validity testing of the Hand Dermatitis Screening Tool. Digital images of participants' hands collected in the first phase were sent by courier to two expert occupational dermatologists for independent assessment and review. Workplace screening results and dermatologist screening results were then examined for agreement. Given the scarcity of the literature on screening for OCD, a gold standard for screening has yet to be established. However, the approaches used in our study have been employed in other studies,^{33,36,37} with varying results.

Descriptive statistics were used to illustrate the prevalence of dermatitis, and the feasibility and importance of screening, by group (self-screening vs screening by an OHN) and occupational group. Screening results were collapsed into a dichotomous variable (normal

TABLE 1 Participant demographics and work history (N = 508)

Demographics	n (%)
Age group (years)	
18-29	105 (21)
30-39	145 (29)
40-49	91 (18)
50-59	134 (26)
≥60	31 (6)
Sex	
Female	411 (81)
Male	96 (19)
Occupation	
Nursing	258 (51)
Allied health	111 (22)
Dietary service	14 (3)
Environmental service	68 (13)
Other	57 (11)
Years working in healthcare	
<1	26 (5)
≥1 to <5	97 (19)
≥5 to <10	99 (20)
≥10 to <20	147 (29)
≥20	139 (27)
Involved in wet work	
Yes	465 (93)
No	36 (7)
Screened by:	
Self	283 (56)
Nurse	225 (44)
Hospital site	
1	208 (41)
2	203 (40)
3	97 (19)

vs positive screen), given the limited number of persons who screened moderate/severe in the study. To investigate the agreement between workplace screening (OHN screening and/or self-screening) and dermatologist screening, Cohen's kappa coefficients (κ) were calculated. Fisher's exact test was used to examine risk factors associated with a

positive screen. Variables with ordered categories, such as age group and number of hand washes per day, were examined with a Cochran-Armitage test for trend. All statistical analyses were conducted in R version 3.5.0³⁸ (RRID:SCR_001905).

3 | RESULTS

A total of 508 staff from three hospitals participated in the study, after exclusion of 29 participants who were not able to complete the study because of being paged back to work or because they did not want their hands photographed (N = 3), or who had visited the clinic for a concern about hand dermatitis (N = 26). There were 225 participants for the nurse-screening method and 283 for the self-screening method. Table 1 outlines participant demographics and work history. Briefly, 81% of the participants in our sample were female, 51% were nurses, and 93% were exposed to wet work.

Of the 508 workers who participated, 69.5% screened normal, 28.3% screened mild, and 2.2% screened moderate/severe (Figure 1). When screening was collapsed into a dichotomous variable, a total of 155 (30.5%) participants screened positive for hand dermatitis. When stratified by occupation, 29.8% of nurses, 30.6% of allied health professionals, 35.3% of environmental service workers and 14.3% of dietary workers screened positive. Approximately 28% of those screened by OHNs screened positive vs 32.5% who self-screened. Factors associated with a positive screen for hand dermatitis included exposure to wet work, having a history of eczema, dermatitis, or other rash, and having a rash present at the time of data collection (Table 2). When we explored our data for any trends, we found a significantly increased presence of positive screens as the number of hand washes per day increased ($P = 0.018$). None of the other factors were significant for trends (number of hours wearing gloves, years working in healthcare, number of glove changes, number of times sanitized, or age). We also analysed factors associated with a positive screen based on the dermatologists' evaluation (data not shown). In this analysis, we found age and years working in healthcare to be significant, in addition to rash in the past year, which remained significant. Exposure to wet work, rash today and eczema were no longer significant risk factors in this analysis.

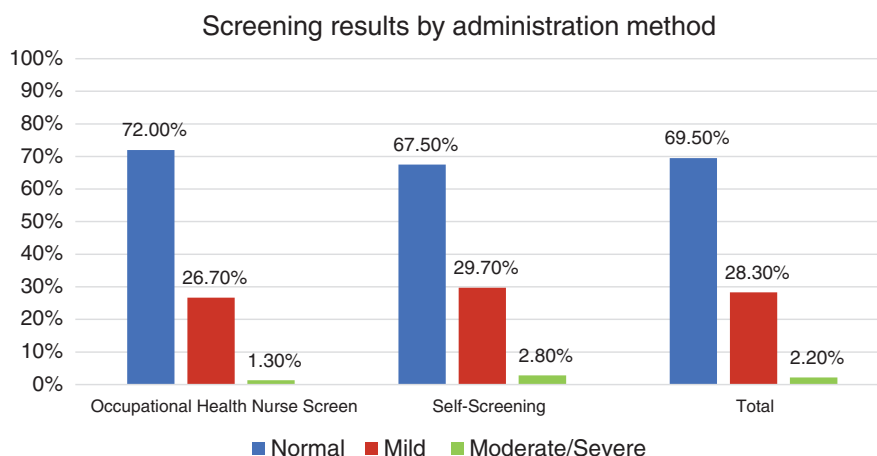
**FIGURE 1** Screening results by administration method

TABLE 2 Risk factors related to a positive screen

	Positive screen (mild/moderate/severe dermatitis), % (n)	Normal screen (no dermatitis), % (n)	P-value
Age group (years)			0.46
18-29	19.4 (30)	21.4 (75)	
30-39	30.3 (47)	27.9 (98)	
40-49	21.9 (34)	16.2 (57)	
50-59	22.6 (35)	28.2 (99)	
≥60	5.8 (9)	6.3 (22)	
Sex			0.33
Male	16.1 (25)	20.2 (71)	
Female	83.9 (130)	79.8 (281)	
Occupation			0.66
Nursing	49.7 (77)	51.3 (181)	
Allied health	21.9 (34)	21.8 (77)	
Dietary service	1.3 (2)	3.4 (12)	
Environmental service	15.5 (24)	12.5 (44)	
Other	11.6 (18)	11.0 (39)	
Years working in healthcare			0.17
<1	4.5 (7)	5.4 (19)	
≥1 to <5	13.5 (21)	21.5 (76)	
≥5 to <10	21.3 (33)	18.7 (66)	
≥10 to < 20	34.2 (53)	26.6 (94)	
≥20	26.5 (41)	27.8 (98)	
Number of hand washes			0.17
0-5	1.3 (2)	3.1 (11)	
6-10	7.8 (12)	13.1 (46)	
11-15	10.4 (16)	13.7 (48)	
16-20	19.5 (30)	16.2 (57)	
>20	61.0 (94)	53.8 (189)	
Number of hours wearing gloves			0.25
0-2	28.1 (43)	26.0 (91)	
3-5	27.5 (42)	22.3 (78)	
6-9	24.2 (37)	23.4 (82)	
≥10	20.3 (31)	28.3 (99)	
Number of glove changes			0.73
0-2	10.7 (16)	11.9 (41)	
3-5	9.4 (14)	9.3 (32)	
6-9	17.4 (26)	13.6 (47)	
≥10	62.4 (93)	65.2 (225)	
Number of times sanitized			0.23
0-5	8.6 (13)	10.8 (38)	
6-10	11.8 (18)	10.5 (37)	
11-20	27.6 (42)	19.9 (70)	
>20	52.0 (79)	58.8 (207)	
Presence of eczema			<0.001
Yes	53.2 (82)	29.8 (105)	
No	46.8 (72)	70.2 (247)	

TABLE 2 (Continued)

	Positive screen (mild/moderate/severe dermatitis), % (n)	Normal screen (no dermatitis), % (n)	P-value
Rash in the past year			<0.001
Yes	61.9 (96)	25.3 (89)	
No	38.1 (59)	74.7 (263)	
Rash today			<0.001
Yes	45.8 (44)	9.1 (8)	
No	54.2 (52)	90.9 (80)	
Rash treated			0.69
Yes	38.6 (17)	25.0 (2)	
No	61.4 (27)	75.0 (6)	
Exposed to wet work			0.024
Yes	96.8 (149)	91.1 (316)	
No	3.2 (5)	8.9 (31)	

Feasibility results showed that 94% of participants (OHN-screened or self-screened) indicated that using the tool took <2 minutes. Almost all participants (99%) indicated that the tool was easy or very easy to use. When asked whether workplace screening for hand dermatitis was not important, somewhat important, or very important, 430 participants (86%) answered "very important" and an additional 12% answered "somewhat important." When feasibility results were compared between OHN screening and self-screening, nurses were more likely to report screening for hand dermatitis as being very important, that the tool was very easy to use, and that it took <1 minute to use ($P = 0.001$).

Workplace screening was compared with ratings from one dermatologist, as the other experienced difficulty in rating digital photographs on their computer. Workplace (OHN screening or self-screening) and dermatologist photo screening showed fair agreement (weighted $\kappa = 0.27$). In addition, when we further analysed the data separately for OHN screening and self-screening, we found that both were in fair agreement ($\kappa = 0.21$ – 0.40)³⁹ with the dermatologist's rating (self-screening weighted $\kappa = 0.30$; OHN screening weighted $\kappa = 0.23$). The main source of disagreement between workplace (either OHN screening or self-screening) and dermatologist screening concerned the distinction between the "normal" and "mild" screening categories, with the dermatologist being more likely to report mild changes than OHNs or participants using the self-screening method (Table 3).

4 | DISCUSSION

Our results indicate that almost one in three HCWs screened positive for hand dermatitis across our three study sites. Our results are similar to those reported in the literature indicating that HCWs have a higher prevalence of hand dermatitis than the general population.⁷⁻⁹ This is probably attributable to the nature of the work, as a very high percentage (93%) of participants in our study reported that they were exposed to wet work.

TABLE 3 Concordant findings between dermatologist screening and workplace screening (occupational health nurse [OHN] screening and self-screening)

	Normal (workplace), % (n)	Mild (workplace), % (n)	Moderate/severe (workplace), % (n)
Normal (dermatologist)	58.4 (206)	36.1 (52)	0.0 (0)
Mild (dermatologist)	41.4 (146)	60.4 (87)	72.7 (8)
Moderate/severe (dermatologist)	0.3 (1)	3.5 (5)	27.3 (3)
Total	100.0 (353)	100.0 (144)	100.0 (11)
$\kappa = 0.19$ (weighted $\kappa = 0.27$), $N = 508$.			
	Normal (OHN), %, (n)	Mild (OHN), % (n)	Moderate/severe (OHN), % (n)
Normal (dermatologist)	59.9 (97)	35.0 (21)	0.0 (0)
Mild (dermatologist)	39.5 (64)	63.3 (38)	100.0 (3)
Moderate/severe (dermatologist)	0.6 (1)	1.7 (1)	0.0 (0)
Total	100.0 (162)	100.0 (60)	100.0 (3)
$\kappa = 0.20$ (weighted $\kappa = 0.23$), $N = 225$.			
	Normal (self), % (n)	Mild (self), % (n)	Moderate/severe (self), % (n)
Normal (dermatologist)	57.1 (109)	36.9 (31)	0.0 (0)
Mild (dermatologist)	42.9 (82)	58.3 (49)	62.5 (5)
Moderate/severe (dermatologist)	0.0 (0)	4.8 (4)	37.5 (3)
Total	100.0 (191)	100.0 (84)	100.0 (8)
$\kappa = 0.18$ (weighted $\kappa = 0.30$), $N = 283$.			

Factors related to a positive screen in our study included being exposed to wet work, ever having had eczema/dermatitis, and having a current rash or a history of rash on their hands in the past year. These results are consistent with what has been previously reported in the literature. In their pilot study of HCWs in the hospital setting, Nichol et al³ found that those with a positive screen were more likely to have worked longer in healthcare, wash their hands more frequently, change their gloves more frequently, and wear gloves for a larger proportion of the day.³ However, we only found significantly increased presence of a positive screen as the number of hand washes per day increased. The majority of those who reported having a rash on their hands at time of data collection screened positive for hand dermatitis (84.6%). It is not surprising that this figure was not 100%, as not all rashes are necessarily dermatitis. Of the participants who reported having a rash at the time of data collection and screened positive ($N = 44$), 77.3% screened mild and 22.7% screened moderate/severe. Interestingly, age and years working in healthcare were also shown to be significant risk factors when the analysis in our study was based on the dermatologist's evaluation, with exposure to wet work, rash today and eczema not being significant in this analysis. One potential explanation for this finding is that the occupational dermatologist found more mild disease than OHNs or participants using self-screening. Occupational dermatologists typically see people with disease, and may therefore be better able to notice very subtle changes. Those who are older and have worked in the sector for longer may also be more likely to accept such subtle changes, or assume that they are normal for the job.

The results of feasibility testing of workplace screening with the tool were also promising. After stratification by administration method, in 97.8% of cases screened, OHNs indicated that the tool took <2 minutes to use, in comparison with 90.5% of those who self-screened. Our results suggest that both OHN screening and self-screening are feasible within this context. In addition, workplace

screening for hand dermatitis was seen as very important among our sample, with 95.9% of OHNs and 77.9% of those who self-screened indicating that screening for hand dermatitis was very important. The difference among the two groups is expected, as OHNs have expertise in, and advanced knowledge of, the significance of this occupational disease. However, on investigation of the proportion of participants who indicated that screening was somewhat or very important, the differences between the two groups were minimal (100% of OHNs vs 95.7% of those who self-screened). Despite the differences between OHN screening and self-screening being statistically significant, the results for self-screening were also in support of the value of screening and of screening taking a short time to complete. One consideration may be that further encouragement may be needed in implementing self-screening in the workplace as opposed to OHN screening. These findings support the need for healthcare organizations to address education and awareness of the benefits of prevention and early detection, and embed mechanisms for the performance of routine workplace screening for hand dermatitis.

Validity testing results of the tool between workplace screening and screening completed by a dermatologist showed only fair agreement between the two methods. Although no gold standard for dermatitis screening has been established, several studies are available that have employed similar approaches.^{33,37,40,41} Timmerman et al³⁷ used a consensus method whereby experts collaborated in determining ratings. In this study, agreement between the expert diagnosis and self-reported outcomes was low. Coenraads et al³³ compared 11 physician raters, and showed higher inter-rater reliability and test-retest reproducibility with a photo guide that employed five levels of disease severity. Although this study showed higher agreement, a large number of experts were utilized and the sample size was low, with only 28 participants. A recent study by Parsons et al⁴⁰ also developed a protocol for the diagnosis

of hand dermatitis using hand photographs. Their results showed only fair agreement between two dermatologists when they conducted independent reviews of 70 and 71 sets of hand photographs. One potential contributing factor to the fair agreement found in our study between workplace and dermatologist screening could be the use of three different Research Assistants and multiple nurses who completed the data collection and screening across hospital sites. In addition, workplace screening was conducted with direct observation vs photo observation by the dermatologist. Moreover, dermatologists typically see patients referred to them with symptoms/illness rather than conducting routine screening among a large population that may include a significant proportion of individuals with normal findings. It would be interesting to explore intra-rater reliability with a single dermatologist viewing the same photograph multiple times as opposed to consistency with other dermatologists.

More studies are needed to inform best practices in testing agreement that are feasible to employ. It is not surprising that the main source of disagreement in our study was between the "normal" and "mild" screening categories. The mild screening category includes small areas of the hands with slight redness and/or dryness, which may be much more difficult to distinguish with certainty than the moderate/severe category, which includes large areas of the hands with slight redness and/or dryness or small areas of the hands with severe redness and/or dryness. Some health professionals may have more conservative approaches to dermatitis screening, as they may consider very small areas of redness or very minor breaches of skin integrity as normal, in contrast to dermatologist screening. Previous work has also shown that obtaining agreement on the very mild/mild categories of disease severity is much more difficult than obtaining agreement on the moderate or severe cases.⁴⁰ This is further exacerbated by a lack of standardized definitions in the literature regarding what constitutes mild hand dermatitis, and by the fact that this is a continuum rather than categories with clear cut-offs. For example, in our study, we employed a three-tier approach, whereby participants could screen as normal, mild, or moderate/severe. Parsons et al⁴⁰ used a five-tier approach characterizing dermatitis as "clear," "almost clear," "moderate," "severe," or "very severe," whereas Baumeister et al³⁶ employed a four-tier approach (no skin changes, discrete skin changes, moderate skin changes, or severe skin changes). Although some preliminary work has been conducted on the identification and management of mild dermatitis,⁴² further studies are needed to inform best practices.

Our findings must be interpreted in light of the study's strengths and limitations. Strengths included a large sample size and involvement of three different hospital networks, which contributes to the generalizability of results across the acute healthcare sector. Our results also suggest that self-screening for dermatitis is as good as OHN screening, which provides further insights into the feasibility of implementing self-screening in the workplace. In addition, multiple nurses completed the OHN screening in our study, which would be reflective of real-world practice if workplace screening was to be implemented in a similar fashion through Occupational Health Services. Regarding limitations, our sample was one of convenience, and included workers who attended appointments at Occupational Health Clinics at three different hospitals. There is the

possibility that individuals who have an occupational health concern may have been more interested and willing to participate in our study. Second, because of the nature of data collection at multiple sites and departments, it was not possible to completely standardize the process of taking photographs. We did, however, have a lead Research Assistant who developed a study manual with particular instructions for taking the photographs, and conducted training with all other Research Assistants. There were several OHNs conducting screening in our study, and we did not have the opportunity to assess inter-rater reliability between them. However, these professionals have received training in conducting comprehensive skin assessments through their entry-to-practice programmes. Workplace screening in our study was also compared with screening by only one dermatologist. Thus, our study would have been strengthened by the use of additional dermatologists or by the exploration of intra-rater reliability for the one dermatologist. Finally, a large proportion of the data collected was from nursing and allied health, limiting the generalizability of our findings to other occupations, including physicians or dietary/environmental workers, in hospital settings. We experienced challenges in the recruitment of dietary and environmental workers because of concerns that data collection on clinical units would result in disruption of workflow. We did, however, collaborate with organizational leadership in order to attend various staff meetings and training sessions to recruit participants and collect data from these specific groups in an effort to minimize work interruption. Future studies should take account of work processes, and establish buy-in from workplace partners early in order to enhance success.

The results of our study have several implications for future research, policy, and practice. Further testing of the sensitivity and specificity of the Hand Dermatitis Screening Tool in additional industry sectors with workers involved in wet work (eg, hairdressing and food services) should be performed to improve early detection and treatment. Moreover, additional studies of validity incorporating comparison of screening results with the gold standard used here (photo screening by occupational dermatologists) are warranted, as we saw only fair agreement. Standardized definitions for the "mild" category of disease severity are also warranted, as this tended to be the area of most disagreement both within our study and in prior work. Future research could also examine the barriers to and facilitators for implementing interventions in healthcare to address the identification and/or prevention of mild hand dermatitis. Our results support embedding workplace screening within organizational policies and practices, given the feasibility of self-screening.

5 | CONCLUSION

The prevalence of, and risk factors for, hand dermatitis identified in the present study are consistent with the literature focused on healthcare, and support further testing and use of the tool despite only fair agreement between workplace and dermatologist screening. Overall, participants indicated that the tool was quick and easy to use in a busy hospital setting, and that workplace screening for hand dermatitis was very important. Our findings suggest: (a) the need for

standardized definitions of what constitutes mild disease severity; and (b) for healthcare organizations to implement workplace screening programmes for hand dermatitis that will contribute to increased knowledge and awareness of this occupational disease and the benefits of prevention and early detection.

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CONFLICTS OF INTEREST

The authors have no conflicts of interest to report.

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