

# The prevalence of hand dermatitis in nurses: a narrative review highlighting the importance of prevention

## Abstract

Hand dermatitis (HD) is a bodily reaction that occurs when the skin becomes inflamed, characterised by red swelling and tiny blisters that form a crust. The clinical aspect varies in accordance with the clinical phases: acute, sub-acute or chronic. Redness, swelling, weeping and blistering are characteristic of the acute phase, when early detection and proper treatment are crucial to prevent it becoming severe or prolonged. Occupational hand eczema is common in “wet work” occupations, especially in the nursing profession, and even more frequent in workplaces where workers have to wash their hands continually. The literature suggests that the prevalence of HD in nurses varies around the world, as is evident from the summary table (below, with references) showing figures for the decade 2005-2015.

The main preventative recommendations are: adequate hand hygiene and glove wearing, regular application of emollients, use of alcohol rubs where appropriate, educational programmes concern the control of skin infections and appropriate hand washing as a routine part of hand care. Regular monitoring in the occupational medical service is essential for primary, secondary and tertiary prevention.

**Keywords:** dermatitis, wet work, emollients, inflammation of the skin, eczema

Volume 2 Issue 1 - 2018

## Antonio Ranchal Sanchez

Faculty of Medicine and Nursing, Reina Sofia University Hospital, Spain

**Correspondence:** Antonio Ranchal Sanchez, Faculty of Medicine and Nursing, Reina Sofia University Hospital, Cordoba, Spain, Email [enlrasaa@uco.es](mailto:enlrasaa@uco.es)

**Received:** November 29, 2017 | **Published:** February 08, 2018

**Abbreviations:** ADI, alcoholic disinfection; CG, control group; HCW, health care worker; HD, hand dermatitis; HE, hand eczema; ICU, intensive care unit; IG, intervention group; OE, occupational exposure; OSD, occupational skin disease; TEWL, trans epithelial water loss; Y, year

## Introduction

Occupational skin disease is any disorder of the skin that is caused or made worse by workplace activity.<sup>1</sup> This term includes occupational hand dermatitis, a condition that occurs frequently in nurses. In current terminology, the term “dermatitis” is used synonymously with “eczema” and describes inflammatory reactions in the skin with a spectrum of clinical and histopathological characteristics.<sup>2</sup> As its suffix suggests, dermatitis refers to “inflammation of the skin”, a reaction that occurs when the skin becomes inflamed and it takes on a red, swollen appearance with tiny blisters that form a crust.

The clinical aspect varies depending on the clinical phases. These are: acute, sub-acute and chronic. Redness, swelling, weeping and blistering are characteristic signs of the acute phase. During the sub-acute phase, redness, dry flaky skin, cracks and crusty exudates are evident. Chronic hand dermatitis is characterized by flaking, scaling, cracking and hand thickening. In line with the clinical evolution, the earlier the condition is detected the better, so as not to allow the progression through the pathological clinical phases.

Occupational hand eczema (OHE) is common in “wet work” occupations,<sup>3-5</sup> the hands being the part of the body mainly affected in the majority of cases, especially in the nursing profession, and even more frequently in workplaces where employees are obliged to wash

their hands continually in order to prevent infections. This occurs in workplaces such as intensive care units (ICUs),<sup>4</sup> emergency care, isolation wards, transplant wards, oncology, etc.,.

The main objective of this study is to describe and compare the prevalence of HD as reported by articles published during the decade 2005-2015. The paper also sets out to emphasise the importance of prevention and hand care measurements.

## Method

The literature from 2005 to 2015 was reviewed. The main search was carried out during a research training period at the Occupational Health Department of the Education Centre, Guy’s and St Thomas’ NHS Trust and King’s College London, UK, June 2015. The literature search was carried out using PubMed and the terms were: dermatitis, dermatoses, eczema, hand and nurses.

The search formula used on PubMed was: (hand dermatoses [MeSH Terms] and nurses [MeSH Terms]

“dermatitis” and “eczema” and “hand” and “nurses”. The inclusion criteria were that the abstract had to be in English and published during the period of study (2005-2015). Articles that analysed care professions other than nurses were excluded.

## Results

Table 1 shows the prevalence of HD in the literature published in the period 2005-2015. The table includes the year of the publication, the main author, the title of the paper and the journal in which it was published, the study type, the country where the study was conducted,

the sample size, how dermatitis was measured (self-assessment, photography, clinical diagnosis), and other comments. A total of 21 references to HD in nurses were found and included in the table. The highest rate of HD prevalence was 82%. Figure 1 is a photograph

of HD in the acute phase; the subject is a nurse whose case came to light during a health monitoring inspection conducted by a hospital's occupational health service.

**Table 1** Hand dermatitis prevalence in literature published 2005-2015

Year	Main author	Title and journal	Study type	Country/ sample size	How dermatitis is measured	Prevalence %	Other comments
2015	Campion KM <sup>1</sup>	A survey of occupational skin disease in UK health care workers Occupational medicine	Questionnaire-based survey	HCWs from United Kingdom, including 232 nurses	A brief skin questionnaire modified from NOSQ) self-completion	In nurses, skin disease: 20% Eczema: 40% Redness: 60%	Nurses who attended vaccine clinics during October-November 2013
2014	Visser et al. <sup>9</sup>	Wet work and hand eczema in apprentice nurses; part I of a prospective cohort study. Contact Dermatitis	A prospective cohort study	The Netherlands 721 apprentice nurses	Designed diary cards recording wet work exposure and HE symptoms	1 <sup>st</sup> Y: 23% 2 <sup>nd</sup> Y: 25% 3 <sup>rd</sup> Y: 31%	Underlined the importance of skin protection in vocational education
2013	Lee et al. <sup>10</sup>	Occupational hand eczema among nursing staffs in Korea: Self-reported hand eczema and contact sensitization of hospital nursing staffs The Journal of Dermatology	Self-administered questionnaire	Korea (General Hospital) Nursing staff 500/700 nurses completed the study	Questionnaire (75% response rate)	Symptom-based HE: 75.6%  Self-reported HE: 31.0%	HE was less prevalent among frequent users of hand moisturisers (> 3-4/day)
2012	Wilke et al. <sup>3</sup>	Long-term effectiveness of secondary prevention in geriatric nurses with occupational hand eczema: the challenge of a controlled study design Contact Dermatitis	Controlled study design	Germany 102 geriatric nurses with occupational HE	Standardised questionnaire and compared baseline (T0), three month follow-up (T1) and six years after intervention (T2)	Morphological signs (vesicles) CG: 40% IG: 12.8%	Cite: "The high prevalence of occupational dermatitis" Interdisciplinary prevention programme (IG). CG medically treated by dermatology
2012	Wilke et al. <sup>3</sup>	Sustainability of interdisciplinary secondary prevention in patients with occupational hand eczema: a 5-year follow-up survey. Contact Dermatitis	Cohort study in a interdisciplinary secondary prevention programme	Germany Wet work occupations 134 patients	Self-reported T0 Baseline T1 9 months T2 5 years	Prevalence and severity of self-reported OHE were significantly reduced compared to T0	An outpatient skin protection seminar comprising dermatological and educational interventions No measurable change in the use of skin care products
2011	Nai-Ming T & Luk et al. <sup>7</sup>	Hand eczema among Hong Kong nurses: a self-report questionnaire survey conducted in a regional hospital Contact Dermatitis	Self-reported questionnaire survey	Hong Kong regional Hospital 1,240 nurses	Self-reported questionnaire, returned anonymously within two weeks (59% response rate)	HE among respondents was 22.1%	More than 90% had moderate-severe HE Psychosocial impact also determined "Preventive measures should be emphasised"

Table Continues

Year	Main author	Title and journal	Study type	Country/ sample size	How dermatitis is measured	Prevalence %	Other comments
2011	Cheng-CheLan et al. <sup>20</sup>	Hand dermatitis among university hospital nursing staff with or without atopic eczema: assessment of risk factors. Contact Dermatitis	Observational study	Kaohsiun Medical University Hospital 1,132 Nurses	Associations between different risk factors and HD were documented	248/1,132 with HD (21.90%)	Only 17% had atopic eczema Try also to identify behavioural risk factors
2011	Kurpiewska et al. <sup>5</sup>	A survey of work-related skin diseases in different occupations in Poland. Int Journ of Occup Safe and Ergonom	Cross-sectional study	Poland (different work populations) 581 healthcare workers	Self-reported skin symptoms on hand and forearm	51% of nurses reported skin disorders	67% of midwives and 41 % of physicians reported skin disorders
2008	Dulon et al. <sup>15</sup>	Prevalence of skin and back diseases in geriatric care nurses Int Arch Occup Environ Health	Cross-sectional study	Germany 1,309 nurses and nurses' aides	Underwent clinical examinations of their hands, and answered a questionnaire	The prevalence of HE was 18.0%	Dry body skin as a risk factor. Workplace health promotion needed
2008	Kromark et al. <sup>19</sup>	Health indicators and preventive behaviour of older employees in geriatric care. Gesundheitswesen	Cross-sectional study	Germany 2,149 nurses working in home care	Questioned in written form and dermatological investigation	HE was not more prevalent in older nurses	The older nurses participated more in advisory sessions on skin protection and applied cream to hands more frequently 2/3 HE
2009	Skudlik et al. [27]	Hand eczema in geriatric nurses in Germany- prevalence and risk factors Contact Dermatitis Nurses' perceptions of the benefits and adverse effects of hand disinfection: alcohol-based hand rubs vs. hygienic handwashing: a multicentre questionnaire study with additional patch testing by the German Contact Dermatitis Research Group. British Journal of Dermatology	Cross-sectional study	Germany 1,375 Geriatric Nurses from 86 nursing homes	Investigated by 41 occupational physicians	HE in 243 nurses 18 % prevalence	developed after starting their profession; Most chronic (85%) Tendency for dry skin
2009	Stutz et al. <sup>18</sup>	Self-reported hand eczema in a hospital population. Contact Dermatitis	A pilot study (PS), followed by a modified multicentre study (MC)	Germany five hospitals	Self-administered questionnaire survey	HD in the MC was 13.4% by self-diagnosis and 22.4% by symptom-based questions	Concordance between the symptom-based diagnosis and the self-diagnosis was limited Nurses perceive ADI as more damaging
2007	Flyvholm et al. <sup>8</sup>	Self-reported hand eczema in a hospital population. Contact Dermatitis	Questionnaire study	Denmark 1909 Hospital (middle size) employees	Frequency of self-reported HE in the previous 12 months	23% overall HE frequency. 30% in nurses	7-50% HE in surgical wards HE more frequent in women and in younger age groups
2007	Lampel et al. <sup>14</sup>	Prevalence of hand dermatitis in inpatient nurses at a United States hospital. Dermatitis	Cross-sectional study	United States inpatient nurses at hospital	Visited twice by a single physician, questioned and diagnosed	55% had HD	65% of ICU nurses had HD With self-reported atopic dermatitis, the prevalence was 71%

Table Continues

Year	Main author	Title and journal	Study type	Country/ sample size	How dermatitis is measured	Prevalence %	Other comments
2005	Smith et al. <sup>13</sup>	Hand dermatitis among Korean nursing students IntJourn of Nursing Practice	Cross-sectional study	270 Korean nursing students from Seoul University.	Validated questionnaire survey (202 from 270 received)	1 <sup>st</sup> Y 6.9% HD 4 <sup>th</sup> Y 22.9% HD	Might be less prevalent compared to their international counterparts
2006	Smith et al. <sup>16</sup>	Hand dermatitis risk factors among clinical nurses in Japan Clin Nurse Research	Cross-sectional study	Japan 1,162 clinical nurses	Questionnaire (Response rate 74%)	The overall HD rate was 53.3%	The use of hand cream was associated with a 50% reduction in HD risk
2005	Szepietowski & Salomon <sup>11</sup>	Hand dermatitis: a problem commonly affecting nurses RoczAkad Med Bialymst.	Cross-sectional study	Poland Hospital nurses	Incidence of self-reported and self-examination HD	About 70% of respondents declared the presence of symptoms of HD within the last 12 months; 46% had skin lesions at the moment of self-examination	Almost 75% of employees with hand dermatitis had observed the worsening of skin problem. 48% of hospital employees with hand eczema reported psychological distress caused by their skin lesions
2005	Jungbauer et al. <sup>22</sup>	Characteristics of wet work in nurses. Int Arch of Occup and Environm Health	Continuous observation	Germany 45 randomly chosen nurses from different wards during a morning shift	Labour observation techniques	No prevalence results. Wet work in ICU accounted for 24% of morning shift duration	They suggest increasing the use of gloves for patient washing in order to reduce the frequency of exposure to water and soap
2005	Schürer et al. <sup>21</sup>	Secondary individual prevention of hand dermatitis in geriatric nurses Int Arch of Occup and Environm Health	Prospective controlled study (3 months)	Germany 209 geriatric nurses	102 (IG) secondary individual prevention 107 (CG) consulting a dermatologist on demand Questionnaire Severity of OSD was classified upon each visit	Upon entry 89% (IG) 90% (CG) Upon study completion 59% (IG) was free of OSD After 3 months questionnaires revealed skin lesions in 53% (IG) and 82% (CG)	Incidence of OSD in geriatric nurses is increasing in Germany  Secondary individual prevention in geriatric nurses is effective in the secondary prevention of OSD.

Table Continues

Year	Main author	Title and journal	Study type	Country/ sample size	How dermatitis is measured	Prevalence %	Other comments
2005	Schmid et al. <sup>17</sup>	Transepidermal water loss and incidence of hand dermatitis prospectively followed cohort of apprentice nurses. Contact Dermatitis	Prospective followed cohort (12 months)	Germany 104 apprentice nurses	Before 1 <sup>st</sup> Y OE 2 <sup>nd</sup> Y OE Standardised questionnaire and clinical examination with skin bioengineering to measure TEWL in dorsum of hand	The 12-month period prevalence of self-reported symptoms HD was 36.5%	Apprentices with self-reported symptoms at the final examination showed a significant increase of TEWL Results do not support the notion that an increase basal TEWL is a good indicator for HD risk
2005	Smith et al. <sup>12</sup>	Prevalence of hand dermatitis among hospital nurses working in a tropical environment. The Australian Journal of Advanced Nursing	Cohort study (12 months)	Australia 148 female nurses from a large tertiary hospital in Queensland	Validated self-reporting HD questionnaire	12-month prevalence ranged from 43.2% to 59.0% with an overall group mean of 50.0%	No statistically significant differences between the different hospital wards. 12-month prevalence of HD was higher than previous reports from other countries



Figure 1 Redness and swelling in acute phase hand dermatitis.

## Discussion

The main objective of this study is to describe and compare the prevalence of HD as reported by academic articles during the decade 2005-2015. Table 1 set out the results of a 10-year review of HD prevalence in nurses.

According to the literature, the prevalence of HD in nurses varies considerably around the world, with reports of 17.7% in mainland China,<sup>6</sup> 20% in the United Kingdom,<sup>1</sup> 22.1% in Hong Kong,<sup>7</sup> 30% in Denmark,<sup>8</sup> 31% in the Netherlands,<sup>9</sup> 31% in South Korea,<sup>10</sup> 40% in Germany,<sup>3</sup> 46% in Poland,<sup>11</sup> 50% in Australia,<sup>12</sup> 53.3% in Japan<sup>13</sup> and 55% in the United States.<sup>14</sup> It also varies according to the way HD is detected (self-reported, appearance of symptoms or clinical observation, or formal diagnosis by a clinician). For example, Campion reports figures of 20% (diseased skin), 40% (eczema) and 60% (redness); Lee et al.<sup>10</sup> report a frequency of 75.6% for symptom-based OHE and 31.0% for self-reported OHE.<sup>10</sup> The workplace is another factor to consider: the wetter hands tend to become, the greater the prevalence. Thus Dulon et al.<sup>15</sup> report 18% of geriatric nurses suffering from OHE, whereas Lampel<sup>14</sup> mentions an HD prevalence of 65% among ICU nurses.<sup>14</sup>



In addition there are endogenous conditions, atopic and vesicular HD being cases in point. Nurses with pre-existing atopic dermatitis are 5.3 times more likely to suffer from HD compared to nurses without this condition.<sup>6</sup> For the latter group, the early detection and reporting of OHE in the initial stages of the disease is of the utmost importance for the effectiveness of secondary prevention, as Wilke et al.<sup>3</sup> point out in their follow-up study.<sup>3</sup> In these cases it is essential that the professionals turn to the occupational health service, so that the service can arrange a reasonable adjustment or redeployment and specific programmes in the case of severe OHE.<sup>3</sup> The occupational health service may recommend temporary restriction from clinical work with immuno-compromised patients after a risk assessment. Visits to the occupational health service are also important in order to manage the cause of irritation or allergy as a means of controlling the exposure. The service will also make an assessment of the most suitable protective clothing, inspecting the affected skin at regular intervals as a matter of ongoing health monitoring. Furthermore, in some countries there may be a legal obligation to detect and notify HD in nurses as a “professional disease” and other issues of tertiary prevention.

Another factor to take into account in the prevalence of HD is the age and training level of nurses. Thus HD rates vary in accordance with the nursing students’ progress in their studies.<sup>16</sup> In their prospective cohort study of 721 apprentice nurses, Visser et al.<sup>9</sup> show a progressively increasing prevalence of HE among their subjects: 23% in the first year, 25% in the second year and 31% in the third year of the follow-up study. They mention frequent hand washing during the traineeships, frequent hand washing at home and having a subsidiary job involving wet work as independent risk factors for this condition. The authors recommend paying more attention to skin protection in vocational education. Proper preventative programmes and suitable education are also suggested.<sup>10</sup>

Most of the tools used to monitor the incidence of HD and skin health are based on questionnaires or clinical observations. There have also been attempts to use biomarkers such as transepidermal water loss.<sup>17</sup> The observations of the nurses themselves remain important however. At least one article suggests that nurses perceive disinfection with alcohol as more damaging than hygienic hand washing.<sup>18</sup>

Among the risk factors reported for HD are youth, having a history of atopic dermatitis, frequent hand washing (>20 times/day) and the prolonged wearing of gloves (>5 minutes).<sup>10</sup> On the other hand, appropriate use of moisturiser is a protective factor, with the pathology being reported less frequently among regular users (>3-4 times/day).<sup>10</sup> Age and appropriate training are thus variables to consider when designing a preventative programme. Kromark et al.<sup>19</sup> report that older nurses participate in advisory sessions on skin protection more and apply cream to their hands more frequently.<sup>19</sup>

A complementary objective of this review is to note the prevention and hand care measures that have been put forward by the authors concerned. Some practical recommendations in this regard include proper and reasonable use of gloves, adequate hand hygiene and washing techniques, avoiding having wet hands (whether frequently or for long periods), avoiding coming into direct contact with chemicals that cause dermatitis, regular application of emollients, the use of alcohol rubs when appropriate, an educational

programme providing advice about controlling skin infections, proper hand washing including the careful rinsing of all detergents and following a regular hand care routine. One suggested routine for using moisturising creams is to apply moisturisers (a fingernail-sized amount) from a dispenser every 2-3 hours, after hand washing with warm water, during breaks and before going to sleep. It is also important to use gloves made from suitable materials when the nurse is allergic to certain substances (latex for instance). Most of the risk factors related to HD<sup>20</sup> are preventable, and it is necessary to emphasise the importance of primary and secondary prevention.<sup>21</sup> Primary prevention is especially important in the case of student nurses. In this respect, health promotion programmes geared towards preventing HD are advisable at any health centre during nursing training courses. The prevention approach needs to be multifaceted, taking into account psychosocial factors likely to achieve behavioural change. The Hands4U control trial among health workers is an example of how such multifaceted approaches can be used to enhance the implementation of recommendations for the prevention of hand eczema.<sup>22,23</sup> In this context, the SCIN trial study<sup>24</sup> provides a promising protocol for securing the behavioural change needed to prevent hand dermatitis in nurses.

A limitation of the latter study is its failure to specify the prevalence at a particular point or over a particular period. Other concerns how the dermatitis was diagnosed. In articles where HD was diagnosed by a clinician, some authors argue that medical records underestimate the true prevalence, since many workers with hand dermatitis do not consult a doctor for their symptoms.<sup>25</sup> Most of the studies measured HD using a questionnaire. Some, such as the “Contact disease severity index<sup>26</sup>” have been validated and standardised.<sup>27,28</sup> One of them, the “Nordic Occupational Skin Questionnaire<sup>28</sup>” has been translated into other languages, including Spanish.<sup>29</sup>

## Conclusion

In conclusion, it is evident that HD prevalence differs in accordance with such variables as the way it is measured, the age of the subjects, and the characteristics of the workplace. The high prevalence reported by some studies calls for more attention to be paid to this condition and for educational programmes that employ a multifaceted strategy; they also highlight the central role of occupational health services in the early detection of HD and the implementation of preventative measures, including education in a routine aimed at improving hand care in wet work occupations such as nursing.

## Acknowledgements

None.

## Conflicts of interest

The author declared that there are no conflicts of interest.

## References

1. Campion KM. A survey of occupational skin disease in UK health care workers. *Occup med.* 2015;65(1):29–31.
2. White IR. Skin Disorders. *ABC of occupational and environmental medicine.* David Snashall, et al, editors. Oxford, UK: Wiley-Blackwell; 2012.

3. Wilke A, Gediga G, Schlesinger T, et al. Sustainability of interdisciplinary secondary prevention in patients with occupational hand eczema: a 5 year follow-up survey. *Contact Dermatitis*. 2012;67(4):208–216.
4. Jungbauer FH, Steenstra FB, Groothoff JW, et al. Characteristics of wet work in nurses. *Int Arch of Occup and Environ Health*. 2005;78(3):278–251.
5. Kurpiewska J, Liwkowicz J, Benczek K, et al. A survey of work-related skin diseases in different occupations in Poland. *Int J Occup Saf Ergon*. 2011;17(2):207–214.
6. Smith DR, Wei N, Zhao L, et al. Hand dermatitis among nurses in a newly developing region of Mainland China. *Int J Nurs Stud*. 2005;42(1):13–19.
7. Luk NM, Lee HC, Luk CK, et al. Hand eczema among Hong Kong nurses: a self-report questionnaire survey conducted in a regional hospital. *Contact Dermatitis*. 2011;65(6):329–335.
8. Flyvholm MA, Bach B, Rose M, et al. Self-reported hand eczema in a hospital population. *Contact Dermatitis*. 2007;57(2):110–115.
9. Visser MJ, Verberk MM, van Dijk FJ, et al. Wet work and hand eczema in apprentice nurses; part I of a prospective cohort study. *Contact dermatitis*. 2014;70(1):44–55.
10. Lee SW, Cheong SH, Byun JY, et al. Occupational hand eczema among nursing staffs in Korea: Self-reported hand eczema and contact sensitization of hospital nursing staffs. *J Dermatol*. 2013;40(3):182–187.
11. Szepietowski J, Salomon J. Hand dermatitis: a problem commonly affecting nurses. *Rocz Akad Med Bialymst*. 2005;50(1):46–48.
12. Smith DR, Smyth W, Leggat PA, et al. Prevalence of hand dermatitis among hospital nurses working in a tropical environment. *Aust J Adv Nurs*. 2005;22(3):28–32.
13. Smith DR, Adachi Y, Mihashi M, et al. Hand dermatitis risk factors among clinical nurses in Japan. *Clin Nurs Res*. 2006;15(3):197–208.
14. Lampel HP, Patel N, Boyse K, et al. Prevalence of hand dermatitis in inpatient nurses at a United States hospital. *Dermatitis*. 2007;18(3):140–142.
15. Dulon M, Kromark K, Skudlik C, et al. Prevalence of skin and back disease in geriatric care nurses. *Int Arch Occup Environ Health*. 2008;81(8):983–992.
16. Smith DR, Choe MA, Jeong JS, et al. Hand dermatitis among Korean nursing students. *Int Journal of Nursing Practice*. 2006;12(3):160–165.
17. Schmid K, Broding HC, Uter W, et al. Transepidermal water loss and incidence of hand dermatitis in a prospectively followed cohort of apprentice nurses. *Contact dermatitis*. 2005;52(5):247–253.
18. Stutz N, Becker D, Jappe U, et al. Nurses' perceptions of the benefits and adverse effects of hand disinfection: alcohol-based hand rubs vs. hygienic handwashing: a multicentre questionnaire study with additional patch testing by the German contact dermatitis research group. *Br J Dermatol*. 2009;160(3):565–572.
19. Kromark K, Dulon M, Nienhaus A. Health indicators and preventive behaviour of older employees in geriatric care. *Gesundheitswesen*. 2008;70(3):137–144.
20. Lan CC, Tu HP, Lee CH, et al. Hand dermatitis among university hospital nursing staff with or without atopic eczema: assessment of risk factors. *Contact Dermatitis*. 2011;64(2):73–79.
21. Schürer NY, Klippel U, Schwanitz HJ. Secondary individual prevention of hand dermatitis in geriatric nurses. *Int Arch Occup Environ Health*. 2005;78(2):149–157.
22. Van der Meer EW, Boot CR, et al. Hands4U: the effectiveness of a multifaceted implementation strategy on behaviour related to the prevention of hand eczema—a randomized controlled trial among healthcare workers. *Occup Environ Med*. 2014;71(7):492–499.
23. Van der Meer EW, Boot CR, Jungbauer FH, et al. Implementation of recommendations for hand eczema through a multifaceted strategy. A process evaluation among health care workers. *Acta Derm Venereol*. 2014;94(6):651–657.
24. Madan I, Parsons V, Cookson B, et al. A behavioural change package to prevent hand dermatitis in nurses working in the National Health Service (the SCIN trial): study protocol for a cluster randomised controlled trial. *Trials*. 2016;17(1):145.
25. Smit HA, Burdorf A, Coenraads PJ. Prevalence of hand dermatitis in different occupations. *IntJourn of Epidemiol*. 1993;22(2):288–293.
26. Curr N, Dharmage S, Keegel T, et al. The validity and reliability of the occupational contact dermatitis disease severity index. *Contact Dermatitis*. 2008;59(3):157–164.
27. Skudlik C, Dulon M, Pohrt U, et al. Osnabrueck hand eczema severity index- a study of the interobserver reliability of a scoring system assessing skin diseases of the hands. *Contact dermatitis*. 2006;55(1):42–47.
28. Susitaival P, Flyvholm MA, Meding B, et al. Nordic Occupational Skin Questionnaire (NOSQ-2002): a new tool for surveying occupational skin diseases and exposure. *Contact Dermatitis*. 2003;49(2):70–76.
29. Sala-Sastre N, Herdman M, Navarro L, et al. Dermatitis profesionales. Adaptación transcultural del cuestionario Nordic Occupational Skin Questionnaire (NOSQ-2002) del inglés al castellano y al catalán. *Actas Dermosifiliogr*. 2009;100(8):685–692.