Prevalence of Dermatitis in the Working Population, United States, 2010 National Health Interview Survey

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Background *Prevalence patterns of dermatitis among workers offer clues about risk factors and targets for prevention, but population-based estimates of the burden of dermatitis among US workers are lacking.*

Methods *Data from an occupational health supplement to the 2010 National Health Interview Survey (NHIS-OHS) were used to estimate the prevalence of dermatitis overall and by demographic characteristics and industry and occupation (I&O) of current/ recent employment.*

Results *Data were available for 27,157 adults, including 17,524 current/recent workers. The overall prevalence rate of dermatitis among current/recent workers was 9.8% (range among I&O groups: 5.5–15.4%), representing approximately 15.2 million workers with dermatitis. The highest prevalence rates were among I&O groups related to health care. Overall, 5.6% of dermatitis cases among workers (9.2% among healthcare workers) were attributed to work by health professionals.*

Conclusions *Dermatitis affected over 15 million US workers in 2010, and its prevalence varied by demographic characteristics and industry and occupation of employment. The prevalence rate of work-related dermatitis based on the NHIS-OHS was approximately 100-fold higher than incidence rates based on the Bureau of Labor Statistics' Survey of Occupational Illness and Injury.* Am. J. Ind. Med. 56:625–634, 2013. *Published 2012. This article is a U.S. Government work and is in the public domain in the USA.*

KEY WORDS: *industry; occupations; dermatitis; occupational diseases*

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Disclosure Statement: The authors report no conflicts of interests.

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INTRODUCTION

Dermatitis results from direct skin contact with a substance that is an irritant or allergen, or indirect contact via contaminated clothing or airborne deposition of an aerosol [Lachapelle, 1986]. Clinically, contact dermatitis may be expressed as an acute, subacute, or chronic illness. It is a common condition in the general population, and is often attributed to substances in the workplace [Behrens et al., 1994]. Occupational dermatitis is thought to be appreciably underestimated by the Bureau of Labor Statistics' (BLS) annual Survey of Occupational Illness and Injury (SOII) because most cases are unlikely to meet reporting criteria (i.e., only moderate-to-severe cases are captured).

Therefore, other sources of data on this condition are needed [Lushniak, 2003].

In 2010, the National Institute for Occupational Safety and Health (NIOSH) sponsored an occupational health supplement (OHS) to the National Health Interview Survey. The 2010 NHIS-OHS collected data on the prevalence of many common workplace exposures and addressed three commonly work-related conditions: dermatitis, carpal tunnel syndrome (CTS), and asthma. The prevalence of dermatitis and CTS is not routinely measured with the NHIS, and national prevalence estimates for them are rare.

In one of the first reports of the results of the 2010 NHIS-OHS, we focus on the reported prevalence and work-relatedness of dermatitis among civilian non-institutionalized adults who were working at the time of interview, or who had worked in the past year. The prevalence and work-relatedness of asthma and CTS among workers are addressed elsewhere [Luckhaupt et al., 2012]. Differences in overall prevalence of dermatitis are examined by demographic characteristics, industry of employment, and occupation. Although it is difficult to attribute specific cases to specific occupational exposures from survey data, dermatitis is commonly caused or exacerbated by workplace factors; therefore, patterns of the total prevalence of dermatitis among groups of workers offer clues about risk factors and targets for prevention. Where sample sizes allow, differences in the proportion of cases attributed to work by healthcare professionals are also examined.

METHODS

National Health Interview Survey

The NHIS is a cross-sectional in-person household survey conducted continuously since 1957 by the National Center for Health Statistics (NCHS), Centers for Disease Control and Prevention (CDC). Data are collected on the civilian non-institutionalized population of the United States, and thus exclude persons in long-term care facilities (e.g., nursing homes) or correctional facilities, active-duty Armed Forces personnel (although civilian family members are included), and US nationals living in foreign countries [Pleis et al., 2010]. The survey uses a multi-stage clustered sample design, with oversampling of black, Hispanic, and Asian persons, and produces nationally representative data on health insurance coverage, healthcare access and utilization, health status, health behaviors, and other health-related topics.

The NHIS questionnaire consists of a core set of questions that remain relatively unchanged from year to year, and supplemental questions that vary from year to year to collect additional data pertaining to current health

issues of national importance. The core survey instrument has four main modules: Household, Family, Sample Child, and Sample Adult. The first two modules collect health and sociodemographic information on each member of each family residing within a sampled household. Within each family, additional information is collected from one randomly selected adult (the ''sample adult'') aged 18 years or older and (if applicable) one randomly selected child (the ''sample child'') aged 17 years or younger. In rare instances when a sample adult is physically or mentally unable to respond, proxy responses are accepted ($<1.5\%$ of sample). In 2010, NHIS interviews were conducted in 34,329 households, accounting for 89,976 persons in 35,177 families. The estimates presented in this article are based on data collected from 27,157 sample adults. The household response rate was 79.5%, the conditional sample adult response rate (i.e., the response rate for those sample adults identified as eligible) was 77.3%, and the final sample adult response rate (i.e., the response rate that takes into account both the conditional sample adult response rate and the household/family response rate) was 60.8%.

Information from survey questions regarding employment status and the industry and occupation of those currently employed was obtained from the Sample Adult core module. Demographic characteristics were obtained from questions asked in the Household and Family core modules.

Occupational Health Supplement

The National Institute for Occupational Safety and Health (NIOSH) sponsored an occupational health supplement (OHS) to the 2010 NHIS to collect information on the prevalence and correlates of work-related health conditions and exposures to potential psychological and physical occupational hazards in the US working population. The OHS questions were embedded within the Sample Adult questionnaire. The 2010 NHIS sample included 17,524 sample adults who had worked at least part of the 12 months preceding their interviews; most of the OHS questions focused on these respondents. Information regarding the industry and occupation of most recent employment for those sample adults not currently employed but employed in the past 12 months, and information about dermatitis was obtained from the OHS supplemental questions.

Ethics Board Approval and Consent

The 2010 National Health Interview Survey (NHIS) was approved by the Research Ethics Review Board of the National Center for Health Statistics (Protocol #2009-16) and the U.S. Office of Management and Budget (Control

#0920-0214). Written consent for participation in the 2010 NHIS was not received, but instead all 2010 NHIS respondents provided oral consent prior to participation.

Study Definitions

Cases of dermatitis were identified with the question: "During the past 12 months, have you had dermatitis, eczema, or any other red, inflamed skin rash?" For this study, we classified sample adults into three categories according to their employment history: employed in the past 12 months (current/recent workers); not employed in the past 12 months, but employed at some time in the past (former workers); and never employed. Follow-up questions about dermatitis were asked of current/recent workers who reported a skin condition in the past 12 months. These questions asked "Have you ever seen a doctor or other health professional for your skin condition?" and if so, "Have you been told by a doctor or other health professional that your skin condition was probably work-related?" For those respondents who stated that they had been told by a health professional that their skin condition was probably work-related, additional questions were asked to ascertain whether the condition was related to their current/most recent job, longest held job, or to a previous job.

We also classified current/recent workers according to several demographic characteristics: sex, age group, race/ethnicity, marital status, education, place of residence, and region. Analysis by educational status was limited to workers aged 25 years and over. Geographic classification was based on the location of a respondent's home, and included region and place of residence. Each respondent's residence was classified by metropolitan statistical area (MSA): large, small, or not in an MSA. An MSA is defined by the United States (US) Office of Management and Budget and is typically centered around a single large city that wields substantial influence over the region included in the MSA. Large MSAs have a population size of 1,000,000 or more, small MSAs have a population size of <1,000,000, and "not in MSA" consists of persons not living in a metropolitan statistical area.

For industry and occupation classification, the NHIS obtains open-ended responses from each employed adult respondent (age 18 years and over) regarding his/her industry (employer's type of business) and occupation (employee's type of work). Adults who were employed in the week prior to interview are asked about their current *main* job or business. Supplemental questions were designed to collect information about the most recently held job for adults who were not employed in the week prior to interview but were employed at some time in the past 12 months. These responses were reviewed by U.S. Census Bureau coding specialists who assigned 4-digit industry and occupation (I&O) codes based on the 2007 North American Industrial Classification System (NAICS) and 2010 Standard Occupational Classification (SOC) system. To allow for more reliable estimates, we used less detailed 2-digit I&O recodes in this article. The industry recodes include 21 simple categories (based on NAICS sectors; Table III), and the occupation recodes include 23 simple categories (based on SOC major groups; Table IV).

Data Analyses

To account for the complex sampling design of the NHIS, analyses were completed using SAS-callable SUDAAN software version 10.0 [RTI, 2008]. To represent the US civilian, non-institutionalized population age 18 years and over, and to estimate the total number of employed US civilian workers represented by each individual in the sample, all estimates were weighted using the NHIS sample adult record weight. Point estimates with a relative standard error (RSE) such that $30\% < RSE \leq 50\%$ are noted in the text and marked with an asterisk (*) in the tables, and estimates with a RSE > 50% or based on sample sizes ≤10 cases are not reported.

In order to assess prevalence patterns of dermatitis among workers by I&O group, we ranked groups from highest to lowest unadjusted (see below) prevalence rate. Note that these rankings do not account for whether or not the differences between estimates were statistically significant. However, we did calculate significance tests that tested for statistically significant differences between the I&O groups with the highest prevalence rates of dermatitis, and the prevalence rate of dermatitis for all current/recent workers combined. These significance tests were adjusted such that the estimated standard error of the difference between prevalence rates for I&O groups and all current/recent workers accounted for non-independence of I&O groups and all current/recent workers by incorporating their covariance [a method used in Cohen and Makuc, 2008]. Differences that were statistically significant ($P < 0.05$) are noted in the text.

When examining the prevalence of dermatitis among various I&O groups, we compared both unadjusted prevalence rate estimates and prevalence rate estimates that were adjusted by age, sex, and race/ethnicity using the projected 2000 US population as the standard population [Day, 1996]. Rankings of I&O groups resulting from these two types of comparisons should be interpreted differently, and can serve different purposes. The unadjusted estimates reflect the "true" prevalence rate of dermatitis within the various I&O groups. Rankings based on these estimates are useful for comparisons to unadjusted data from other sources (e.g., BLS SOII) and for identifying groups of workers with the highest burden of disease to target with

preventive strategies, such as hazard exposure control, better personal protective equipment selection, and skin hygiene educational programs. On the other hand, rankings based on the unadjusted estimates may be influenced by the non-random distribution of demographic groups with relatively high underlying (non-occupational) risk of dermatitis (e.g., females, older workers). Therefore, rankings based on the adjusted estimates may be more useful for supporting existing or generating new hypotheses about workplace risk factors for dermatitis.

RESULTS

Employment status data were available for 27,157 sample adults in the 2010 NHIS, who represent approximately 229 million civilian non-institutionalized US adults (Table I). The sample included 17,524 adults (weighted proportion = 67.7%) who were employed in the past 12 months (current/recent workers); 7,915 (26.7%) who were not employed in the past 12 months, but were employed at some time in the past (former workers); and 1,704 (5.7%) who were never employed (Table I).

Prevalence of Dermatitis

The overall prevalence rate of reported dermatitis among sample adults was 10.2% (95% CI 9.7–10.6), ranging from 7.3% (95% CI 5.9–9.1) among those never employed to 11.8% (95% CI 10.9–12.7) among former workers (Table I; $P < 0.05$ for all pair-wise comparisons). The prevalence rate among current/recent workers was 9.8% (95% CI 9.2–10.3), representing approximately 15.2 million workers with dermatitis. As shown in Table II, among current/recent workers, prevalence rates were higher among females (11.2%; 95% CI 10.4–12.0) than among males (8.5%; 95% CI 7.8–9.3); among Non-Hispanics of other races (15.6%; 95% CI 11.7–20.4) compared to non-Hispanic whites (10.9%; 95% CI 10.1–11.6),

non-Hispanic blacks (7.9%; 95% CI 6.7–9.3), non-Hispanic Asians (8.8%; 95% CI 7.0–11.0), and Hispanics (5.6%; 95% CI 4.7–6.5); and among those with some college education (10.9%; 95% CI 9.9–12.1) or a college degree (10.8%; 95% CI 9.9–11.8) compared to those with less than a high school diploma (6.3%; 95% CI 4.9–8.1). All the differences mentioned here were statistically significant ($P < .05$).

Industry categories for which the highest unadjusted prevalence rates of reported dermatitis were observed (Table III) included healthcare and social assistance (11.9%; 95% CI 10.5–13.6; $P < .01$ when compared to the prevalence among current/recent workers), public administration (11.7%; 95% CI 9.6–14.3), finance and insurance (11.4%; 95% CI 9.1–14.2), and education services (11.4%; 95% CI 9.8–13.2). After adjustment for age, sex, and race/ethnicity, workers in the arts, entertainment, and recreation industries had the highest prevalence rate of dermatitis (12.6%; 95% CI 8.5–18.3), followed by healthcare and social assistance (12.5%; 95% CI 10.2–15.3) and accommodation and food services (12.4%; 95% CI 9.0–17.0; Table III).

The occupation categories for which the highest unadjusted prevalence rates of reported dermatitis were observed (Table IV) included life, physical, and social science (15.4%; 95% CI 10.3–22.3); art, design, entertainment, sports, and media (15.1%; 95% CI 11.1–20.1 $P < .05$ when compared to the prevalence among current/recent workers); and healthcare practitioners and technical occupations (14.4%; 95% CI 11.9–17.2 $P < .001$ when compared to the prevalence among current/recent workers). After adjustment for age, sex, and race/ethnicity, these first two occupational groups remained the top two in prevalence rates of dermatitis (18.2%; 95% CI 13.3–24.2 and 15.6%; 95% CI 11.7–20.4, respectively), but the personal care and service occupations climbed to the third spot with an adjusted prevalence rate of 14.8% (95% CI 11.2–19.3; Table IV).

TABLE I. Prevalence of Dermatitis Among US Adults, by Employment Status

Employment status	Sample[a]	Est. population (in thousands)	Cases[a]	Unadjusted % (95% CI)	Adjusted[b] % (95% CI)
Employed in past 12 months	17,524	155,262	1,662	9.8 (9.2–10.3)	10.1 (9.5–10.7)
Not employed in past 12 months, but employed some time in past	7,915	61,189	855	11.8 (10.9–12.7)	11.9 (10.7–13.3)
Never employed	1,704	12,979	123	7.3 (5.9–9.1)	8.7 (6.2–12.3)
Total	27,143	229,430	2,640	10.2 (9.7–10.6)	10.4 (9.9–10.9)

Est., estimated; CI, confidence interval.

Cases of dermatitis include adults who reported having dermatitis, eczema, or any other red, inflamed skin rash in the past 12 months. Data include US adults who are part of the civilian non-institutionalized population. All estimates weighted unless otherwise noted.

Source: National Center for Health Statistics, National Health Interview Survey, 2010.

[a]Unweighted.

[b]Estimates adjusted by age, sex, and race/ethnicity using the projected 2000 US population as the standard population.

TABLE II. Prevalence and Work-Relatedness of Dermatitis Among US Adults Who Worked in the Past 12 Months, by Demographic Characteristics

	Sample[a]	Est. population (in thousands)	Prevalence		Proportion attributed to work	
			Cases[a]	% (95% CI)	Cases[a]	% (95% CI)
Sex						
Male	8,500	81,412	697	8.5 (7.8–9.3)	49	6.1 (4.4–8.3)
Female	9,024	73,850	965	11.2 (10.4–12.0)	49	5.2 (3.6–7.3)
Age group (years)						
18–29	4,059	38,916	362	9.0 (7.9–10.2)	26	7.4 (4.6–11.7)
30–44	5,967	49,624	565	10.3 (9.4–11.2)	31	4.9 (3.3–7.1)
45–64	6,506	59,041	632	9.6 (8.8–10.5)	38	5.6 (3.9–7.9)
≥65	992	7,681	103	11.4 (9.3–13.9)	†	†
Race/ethnicity						
Non-Hispanic white	9,997	106,033	1,099	10.9 (10.1–11.6)	58	5.2 (3.8–6.9)
Non-Hispanic black	2,600	16,822	204	7.9 (6.7–9.3)	13	7.1 (3.9–12.6)
Non-Hispanic Asian	1,112	7,278	98	8.8 (7.0–11.0)	†	†
Non-Hispanic other race	351	2,856	59	15.6 (11.7–20.4)	†	†
Hispanic	3,464	22,273	202	5.6 (4.7–6.5)	16	7.3 (4.3–12.1)
Marital status						
Married	8,105	86,431	770	9.9 (9.1–10.7)	43	5.0 (3.6–7.0)
Widowed	514	2,902	53	10.2 (7.5–13.8)	†	†
Divorced or separated	2,983	17,626	280	9.8 (8.6–11.1)	21	8.8 (5.7–13.4)
Never married	4,661	35,565	450	9.6 (8.5–10.8)	23	4.9 (2.7–8.6)
Living with partner	1,232	12,564	109	9.6 (7.9–11.6)	11	*8.4 (4.5–15.3)
Education[b]						
Less than HS diploma	1,812	13,049	98	6.3 (4.9–8.1)	11	*9.4 (4.8–17.8)
HS/GED diploma	3,685	32,164	310	8.9 (7.8–10.0)	21	6.9 (4.3–10.9)
Some college	4,656	39,755	487	10.9 (9.9–12.1)	28	5.4 (3.6–7.9)
BA/BS degree and higher	5,284	48,309	588	10.8 (9.9–11.8)	24	3.5 (2.3–5.3)
Place of residence						
Large MSA	9,796	84,106,619	910	9.5 (8.8–10.2)	54	5.4 (4.0–7.3)
Small MSA	5,266	48,741,054	539	10.6 (9.5–11.7)	34	6.0 (3.9–9.2)
Not in MSA	2,462	22,414,415	213	9.2 (7.8–10.8)	10	*5.3 (2.8–9.7)
Region[c]						
Northeast	2,685	27,042,810	294	10.6 (9.3–12.2)	17	5.8 (3.4–9.5)
Midwest	3,948	36,931,599	372	9.4 (8.3–10.6)	18	4.0 (2.5–6.6)
South	6,421	54,415,112	573	9.6 (8.7–10.5)	38	6.2 (4.2–9.1)
West	4,470	36,872,567	423	9.8 (8.8–10.9)	25	6.2 (3.8–10.0)
Total	17,524	155,262,088	1,662	9.8 (9.2–10.3)	98	5.6 (4.4–7.1)

Cases of dermatitis include adults who reported having dermatitis, eczema, or any other red, inflamed skin rash in the past 12 months. Est., estimated; CI, confidence interval; HS, high school; GED, General Educational Development; BA/BS, bachelor's; MSA, metropolitan statistical area; NCHS, National Center for Health Statistics.

Data include US adults who worked in the past 12 months and are part of the civilian non-institutionalized population. All estimates weighted unless otherwise noted.

Source: NCHS, National Health Interview Survey, 2010.

[a]Unweighted.

[b]Education only shown for persons aged 25 years and over.

[c]States were grouped into the following four regions used by the U.S. Census Bureau: Northeast: ME, VT, NH, MA, CT, RI, NY, NJ, PA; Midwest: OH, IL, IN, MI, WI, MN, IA, MO, ND, SD, KS, NE; South: DE, MD, DC, WV, VA, KY, TN, NC, SC, GA, FL, AL, MS, LA, OK, AR, TX; West: WA, OR, CA, NV, NM, AZ, ID, UT, CO, MT, WY, AK, HI.

*Estimates preceded by an asterisk have a relative standard error >30% and ≤50% and should be used with caution as they do not meet NCHS standards of reliability/precision.

†Estimates with a relative standard error >50% or that are based on cell sizes of ≤10 are not shown as they do not meet NCHS standards of reliability/precision.

TABLE III. Prevalence of Dermatitis Among US Adults Who Worked in the Past 12 Months, by Industry of Employment (NAICS Sector)

				Prevalence	
	Sample[a]	Est. population (in thousands)	Cases[a]	Unadjusted % (95% CI)	Adjusted[b] % (95% CI)
Agriculture, forestry, fishing, and hunting (11)	269	2,308	14	5.5 (3.1–9.5)	7.6 (4.5–12.7)
Mining (21)	75	721	†	†	†
Utilities (22)	140	1,447	11	*6.7 (3.5–12.5)	5.0 (3.2–7.6)
Construction (23)	1,115	10,639	86	8.1 (6.4–10.3)	9.7 (6.7–13.8)
Manufacturing (31–33)	1,590	14,556	135	8.7 (7.2–10.5)	10.6 (7.9–14.0)
Wholesale trade (42)	396	3,780	40	10.2 (7.3–14.1)	8.5 (6.0–11.8)
Retail trade (44–45)	1,795	17,214	144	8.0 (6.5–9.8)	8.0 (6.6–9.8)
Transportation and warehousing (48–49)	714	6,192	42	5.7 (4.1–8.0)	4.8 (3.4–6.8)
Information (51)	450	3,854	46	9.8 (7.0–13.5)	9.9 (6.8–14.1)
Finance and insurance (52)	730	6,365	82	11.4 (9.1–14.2)	10.7 (8.4–13.6)
Real Estate and rental and leasing (53)	344	2,896	34	9.8 (6.7–14.2)	10.7 (7.5–15.2)
Professional, scientific, and technical services (54)	1,153	10,509	134	10.8 (8.9–13.1)	10.5 (8.6–12.8)
Management of companies and enterprises (55)	†	†	†	†	†
Administrative and support and waste management and remediation services (56)	848	6,895	75	8.4 (6.6–10.7)	9.5 (7.3–12.2)
Education services (61)	1,694	15,330	194	11.4 (9.8–13.2)	12.3 (10.3–14.7)
Health care and social assistance (62)	2,444	20,205	267	11.9 (10.5–13.6)	12.5 (10.2–15.3)
Arts, entertainment, and recreation (71)	384	3,420	29	10.0 (6.7–14.7)	12.6 (8.5–18.3)
Accommodation and food services (72)	1,223	10,744	105	10.3 (8.1–12.9)	12.4 (9.0–17.0)
Other services (except public administration; 81)	919	7,791	95	10.8 (8.6–13.5)	11.0 (8.7–13.7)
Public administration (92)	934	8,018	107	11.7 (9.6–14.3)	11.4 (8.9–14.5)

NAICS, North American Industry Classification System; Est., estimated; CI, confidence interval; NCHS, National Center for Health Statistics.

Cases of dermatitis include adults who reported having dermatitis, eczema, or any other red, inflamed skin rash in the past 12 months. Data include US adults who worked in the past 12 months and are part of the civilian non-institutionalized population. All estimates weighted unless otherwise noted.

Source: NCHS, National Health Interview Survey, 2010.

[a]Unweighted.

[b]Estimates adjusted by age, sex, and race/ethnicity using the projected 2000 US population as the standard population.

*Estimates preceded by an asterisk have a relative standard error >30% and ≤50% and should be used with caution as they do not meet NCHS standards of reliability/precision.

†Estimates with a relative standard error >50% or that are based on cell sizes of ≤10 are not shown as they do not meet NCHS standards of reliability/precision.

Work-Relatedness of Dermatitis

Overall, 5.6% (95% CI 4.4–7.1) of dermatitis cases among current/recent workers were reportedly attributed to work by healthcare professionals (Table II), indicating that the prevalence rate of work-related dermatitis among current/recent workers was 0.55% (5.6% of 9.8%) and there were approximately 850,000 prevalent cases of work-related dermatitis among US workers in 2010. However, 24.1% of all current/recent workers with dermatitis had never seen a doctor or other health professional for their skin condition, and therefore their cases could not have been classified as work-related according to our study definition. When excluding these cases from the denominator of the proportion of dermatitis cases related to work, the estimate of work-related dermatitis raises to 7.4% (not shown).

There were too few cases of dermatitis attributed to work by healthcare professionals among most I&O groups to provide reliable estimates of the proportion of cases related to work by I&O, with the exception of the health care and social assistance industry, in which 9.2% (95% CI 5.8–14.1) of workers with dermatitis who were currently/recently employed in this industry reported that their condition was attributed to work by a healthcare professional (not shown). Among current/recent workers with dermatitis attributed to work, 85.2% of these workers attributed their dermatitis to their current/most recent job (not shown).

DISCUSSION

This is one of the first articles to report results from the 2010 National Health Interview Survey Occupational

TABLE IV. Prevalence of Dermatitis Among US Adults Who Worked in the Past 12 Months, by Occupation of Employment (SOC Major Group)

				Prevalence	
	Sample[a]	Est. population (in thousands)	Cases[a]	Unadjusted % (95% CI)	Adjusted[b] % (95% CI)
Management (11)	1,497	14,409	119	7.7 (6.3–9.3)	7.9 (6.5–9.6)
Business and financial operations (13)	821	7,029	94	11.2 (9.0–13.8)	10.5 (8.4–13.1)
Computer and mathematical (15)	471	4,256	48	10.4 (7.4–14.4)	10.5 (6.3–16.9)
Architecture and engineering (17)	305	3,020	38	12.6 (8.9–17.6)	14.3 (10.5–19.2)
Life, physical, and social science (19)	180	1,691	28	15.4 (10.3–22.3)	18.2 (13.3–24.2)
Community and social services (21)	333	2,782	31	9.7 (6.6–14.1)	9.4 (6.3–13.6)
Legal (23)	195	1,809	32	14.4 (10.0–20.4)	13.3 (9.1–18.9)
Education, training, and library (25)	1,125	10,415	137	12.1 (10.1–14.4)	13.6 (10.7–17.1)
Arts, design, entertainment, sports, and media (27)	379	3,251	49	15.1 (11.1–20.1)	15.6 (11.7–20.4)
Healthcare practitioners and technical (29)	855	7,285	115	14.4 (11.9–17.2)	14.2 (10.7–18.5)
Healthcare support (31)	485	3,824	48	10.2 (7.2–14.3)	10.1 (6.0–16.3)
Protective service (33)	358	3,022	27	8.0 (5.3–11.9)	9.2 (5.3–15.4)
Food preparation and serving related (35)	997	8,802	92	10.6 (8.2–13.5)	14.5 (12.1–17.3)
Building and grounds cleaning and maintenance (37)	767	6,023	51	6.3 (4.6–8.7)	7.9 (5.5–11.2)
Personal care and service (39)	672	5,734	72	12.5 (9.5–16.2)	14.8 (11.2–19.3)
Sales and related (41)	1,743	16,176	160	8.7 (7.2–10.5)	8.5 (7.0–10.2)
Office and administrative support (43)	2,400	20,497	243	10.4 (9.0–12.0)	10.5 (8.8–12.4)
Farming, fishing, and forestry (45)	135	1,048	†	†	†
Construction and extraction (47)	906	8,707	63	7.5 (5.7–9.9)	8.0 (5.2–12.3)
Installation, maintenance, and repair (49)	564	5,282	39	6.4 (4.5–9.1)	5.0 (3.0–8.4)
Production (51)	1,053	9,136	83	8.7 (6.9–11.0)	8.6 (6.5–11.4)
Transportation and material moving (53)	978	8,684	69	7.7 (5.9–9.9)	8.2 (6.1–11.1)

SOC, Standard Occupational Classification; Est., estimated; CI, confidence interval; NCHS, National Center for Health Statistics.
Cases of dermatitis include adults who reported having dermatitis, eczema, or any other red, inflamed skin rash in the past 12 months. Data include US adults who worked in the past 12 months and are part of the civilian non-institutionalized population. All estimates weighted unless otherwise noted.
Source: NCHS, National Health Interview Survey, 2010.
[a]Unweighted.
[b]Estimates adjusted by age, sex, and race/ethnicity using the projected 2000 US population as the standard population.
†Estimates with a relative standard error >50% or that are based on cell sizes of ≤10 are not shown as they do not meet NCHS standards of reliability/precision.

Health Supplement (NHIS-OHS). Its focus is the prevalence of reported dermatitis, and the proportion of cases of dermatitis that have been attributed to work by healthcare professionals. This is the first time in 22 years that information on prevalent cases of dermatitis among adults has been collected by the NHIS, the last time being in 1988 as part of the previous occupational health supplement.

For the 2010 NHIS-OHS, reported prevalence of dermatitis was assessed by using the same question wording as the 1988 NHIS-OHS [Park et al., 1993] to facilitate a comparison between these two time points; however, work-relatedness of reported dermatitis was assessed differently in 2010 than in 1988. We found a prevalence rate of reported dermatitis among current/recent workers of 9.8%, slightly lower than the estimate from the 1988 NHIS-OHS where the overall prevalence rate of dermatitis among workers was 11.2% [Behrens et al., 1994]. In the 2010 NHIS-OHS, 5.6% of current/recent workers with dermatitis were told by a health professional that their skin condition was probably work-related, which translates into a prevalence rate of dermatitis attributed to work by health professionals of 0.55% (or 55 cases per 10,000 workers). In contrast, the 1988 NHIS-OHS measured workers' self-attribution of dermatitis to contact with substances at work, yielding a higher prevalence rate estimate for work-related dermatitis of 1.7% [Behrens et al., 1994].

It is of interest to compare the results from the 2010 NHIS-OHS with national statistics on work-related dermatitis that are collected and published by the BLS, because, although there are significant differences in definitions between the two surveys, the BLS SOII is the most frequently cited source for occupational health statistics. The NHIS-OHS would be expected to capture more cases of

work-related illness than the BLS SOII, which is based on OSHA recordkeeping requirements for private industry, for at least three reasons. First, prevalence estimates include chronic ongoing cases, whereas SOII incident rates are limited to incidents meeting the OSHA definition for a new case [OSHA, 2005]. Second, unlike the BLS SOII, the NHIS-OHS is designed to capture cases of any severity, not just those meeting OSHA recordkeeping criteria (i.e., moderate-to-severe cases). Importantly, the OSHA criteria for what is a reportable occupational skin disease changed significantly in 2001, making only more severe cases reportable, which may have influenced not just employer reporting, but also diagnoses by occupational clinicians and workers' compensation systems. Third, there are several groups of workers that are not covered by OSHA: self-employed workers, Federal government workers, and individuals employed on farms with 11 or fewer workers.

Not surprisingly, the 2010 NHIS-OHS prevalence estimates support the assertion that occupational skin disease is appreciably underestimated by the SOII [Lushniak, 2003], which estimated a rate of all OSHA-recordable skin diseases and disorders of 3.4 per 10,000 full-time workers in 2009 [BLS, 2010]. SOII incident rates specific to dermatitis can only be determined for cases resulting in days away from work. Between 2003 and 2009, these rates have ranged from a high of 0.5 per 10,000 full-time workers to 0.3 per 10,000 full-time workers; rates approximately 100-fold lower than the 2010 NHIS-OHS prevalence rate estimate (again, note the case definitions are quite different and not directly comparable). Unfortunately, relatively small unweighted counts of reported dermatitis cases were attributed to work within most I&O groups in the 2010 NHIS-OHS sample, precluding stable estimates of the proportion of cases related to work within most I&O groups.

Endogenous factors previously hypothesized to be important in the development of contact dermatitis include atopy, sex, race/ethnicity, age, and stress [Diepgen et al., 1997]. We did not assess atopy with the 2010 NHIS-OHS, and the relationship between stress and dermatitis is beyond the scope of this paper; but, we did find differences in prevalence rates by sex, race/ethnicity, and age that are somewhat consistent with previous studies. Our finding of a higher prevalence rate of dermatitis among females compared to males is consistent with most previous literature [Diepgen and Coenraads, 2000]. Previous studies have found inconsistent patterns of dermatitis and age, but it has been suggested that aging may increase the skin's susceptibility to injury [Marks et al., 2002]. On the other hand, according to BLS data [BLS, 2011], much higher rates of occupational dermatitis cases leading to days away from work are reported for younger workers compared to older workers. Although we did not find a clear pattern in the overall prevalence rate of dermatitis by age

category in the 2010 NHIS, we did find a much higher proportion of dermatitis among younger workers, compared to older workers, to be attributed to work. The relationship between age and dermatitis may vary depending on whether the dermatitis is related to work. Racial and ethnic differences in susceptibility to contact dermatitis have been discussed in the literature, and are controversial [Diepgen and Coenraads, 2000]. We found differences in dermatitis prevalence rates between race/ethnic groups, with blacks and Hispanics reporting lower prevalence of dermatitis.

As with the 1988 NHIS-OHS, we found a wide range in the prevalence rates of dermatitis among the various industry and occupation groups studied. Although relatively few cases of dermatitis were attributed to work by health professionals, it is likely that the observed patterns in the total prevalence rates of dermatitis among groups of workers at least partially reflect differences in under-recognized workplace factors that can cause or exacerbate this condition, offering clues about risk factors and targets for prevention. This hypothesis is supported by the fact that adults employed in the past 12 months were more likely to report having dermatitis than adults who were never employed. The prevalence rate was even higher among adults who were not employed in the past 12 months but employed sometime in the past, but this group likely includes many adults who left the workforce due to chronic health conditions that increase their risk for dermatitis, and may even include former workers who left the workplace because of dermatitis [i.e., healthy worker effect; Li and Sung, 1999]. The hypothesis that workplace factors contribute to the patterns in prevalence rates by I&O is also supported by the fact that many of the trends persist after adjustment for sex, age, and race/ethnicity.

Our multiple findings of higher prevalence rates of all dermatitis and dermatitis attributed to work by a health professional in I&O groups related to healthcare and of a higher (adjusted) prevalence rate among personal care and service workers are consistent with the occupation groups found to have the highest prevalence rates of dermatitis due to contact with substances at work in 1988: physicians, dentists, nurses, pharmacists, dieticians, and people in related occupations; people in personal service occupations; and healthcare therapists, technologists, technicians, and assistants [Behrens et al., 1994]. Chronic exposure to the irritation from highly frequent daily handwashing and extensive daily use of potentially allergenic (i.e., natural latex rubber) and/or occlusive gloves (i.e., nitrile or vinyl) required for infection control in these I&O groups are likely major contributing factors [Lee and Nixon, 2001; Flyvholm and Lindberg, 2006; Flyvholm et al., 2007].

Our finding of a higher (adjusted) prevalence rate of dermatitis among workers in the arts, entertainment, and

recreation industries is consistent with 2003–2009 BLS SOII data, which indicate that this industry reported one of the highest rates of cases of occupational dermatitis with days away from work [BLS, 2011]. This industry group includes many occupations for which risks of work-related dermatitis have been well described, such as athletes [Kockentiet and Adams, 2007], musicians [Gambichler et al., 2004], and painters [Barchino-Ortiz et al., 2008]. Of note, the industry group with the highest rate of cases of occupational dermatitis with days away from work according to the 2003–2006 BLS SOII data—agriculture, forestry, fishing, and hunting—was one of the groups with the lowest prevalence rate of dermatitis reported through the 2010 NHIS. It should also be noted, however, that too few workers in this industry group were sampled to provide reliable prevalence rate estimates.

Industry and occupation groups with higher prevalence rates of dermatitis suggest opportunities for prevention. Strategies for the prevention of occupational contact dermatitis that have been previously identified by NIOSH include: identification of allergens and irritants (including mixtures and aqueous solutions), substitution of chemicals and gloves/protective clothing that are less irritating or allergenic, establishment of engineering controls to reduce exposure frequency and intensity, careful selection and utilization of personal protective equipment such as gloves and protective clothing, proper change schedules to keep gloves and protective clothing from becoming sources of skin irritation, the emphasizing of personal and occupational skin hygiene, and establishment of educational programs to increase awareness of good skin care practices in the workplace [Lushniak, 2003].

Study Strengths

Including occupational health questions in national population-based surveys such as the NHIS overcomes some of the limitations of widely used occupational health surveillance systems, including the BLS SOII and workers' compensation databases [Lalich and Sestito, 1997]. Unlike the BLS SOII, an NHIS-OHS is representative of all classes of workers and can collect detailed information about work-related conditions that do not result in medical treatment beyond first aid or days away from work. Some filters that lead to underreporting in the BLS SOII do not apply to an NHIS-OHS because information about work-related illnesses and injuries is collected directly from workers outside of the workplace setting [Azaroff et al., 2002].

Limitations

Despite its strengths, this study is subject to several limitations. First, all prevalence estimates for dermatitis are based on a self- or proxy respondent-report of these conditions, which are subject to several types of error [Schenker et al., 2010]. However, there is some evidence from population surveys that included follow-up clinical examination that self-reported dermatitis is reasonably valid [Susitaival et al., 2003]. Second, it is difficult to assess occupational causality of health conditions through self-report. Relying on reported attribution of the condition to work by a health professional likely underestimates work-relatedness [Azaroff et al., 2002], while differences in total prevalence patterns by I&O cannot be assumed to be totally caused by workplace factors. Furthermore, although almost 15% of work-related dermatitis cases were attributed to jobs other than the respondents' current/most recent jobs, we presented prevalence rates stratified by I&O of respondents' current/most recent jobs for simplicity. There are also limitations associated with the I&O groups used in these analyses. On one hand, broad I&O categories lump together workers who likely have substantially different workplace exposures. On the other hand, small sample sizes within some I&O groups result in wide confidence intervals. Ideally the OHS questions would be repeated over multiple years in the NHIS with minimal time lag between administrations (e.g., every 3–5 years). This would allow for sample sizes to increase by pooling data from different years, and for researchers to obtain more stable estimates. However, before this multi-year repetition could happen, funding and other limitations would first have to be overcome. Finally, the economic climate and high unemployment rates in the United States during 2010 should also be considered when interpreting our findings as these conditions could have potentially influenced the NHIS-OHS estimates.

CONCLUSIONS

We found that the overall prevalence rate of dermatitis among current/recent workers was 9.8%, representing approximately 15.2 million workers with dermatitis. Of these cases, 5.6% were attributed to work by health professionals, indicating that at least 850,000 workers experienced work-related dermatitis in 2010. The prevalence and work-relatedness of dermatitis varied by demographic characteristics and industry and occupation (I&O) of employment. Differences in prevalence rates by I&O groups may be related to specific occupational risk factors for dermatitis, a hypothesis that is supported by differences that persist after adjustment for age, sex, and race/ethnicity, or may indicate other reasons for differential reporting of dermatitis among I&O groups. More detailed analyses of 2010 NHIS data may provide more insight into hypotheses raised by the prevalence estimates provided here.

ACKNOWLEDGMENTS

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