

Decreasing Rates of Neomycin Sensitization in Western Canada

John F. Elliott¹, Mariam Abbas¹, Peter Hull², Gillian de Gannes³,
Reza Toussi¹, and Azita Milani¹

Journal of Cutaneous Medicine and Surgery
2016, Vol. 20(5) 446–452
© The Author(s) 2015
Reprints and permissions:
sagepub.com/journalsPermissions.nav
DOI: 10.1177/1023475415623512
jcms.sagepub.com



Abstract

Background: Neomycin contact sensitization rates in North America range from 7% to 13%, whereas in Europe they average approximately 1.9%.

Objectives: Given that topical neomycin products are no longer readily available in Canada, the aim of this study was to examine what influence this may have had on neomycin sensitization rates in the 3 western provinces.

Methods: On the basis of an observation originally communicated by L. M. Parsons and C. Zhang of the University of Calgary, which suggested significantly reduced rates of neomycin sensitization in Calgary, Alberta, Canada, a multicenter study of patch test results from 5690 patient charts was undertaken. Data from 3 other western Canadian Universities (the University of Saskatchewan, the University of Alberta, and the University of British Columbia) were analyzed. Data were available from 2001 to 2013 for the University of Saskatchewan (except 2006), whereas the University of Alberta and the University of British Columbia had data from 2009 to 2013. Descriptive statistics, trend analysis, and risk estimates were determined using SPSS version 20.

Results: Sensitization rates for neomycin have decreased in western Canada and are now similar to those of Europe.

Conclusions: This trend is likely influenced by the reduced availability of over-the-counter and prescription neomycin products in Canada.

Keywords

dermatitis, immunology, dermatology, inflammatory dermatoses

Introduction

Neomycin sensitization was first described in 1952, and neomycin has in the decades since made its way to being named the contact allergen of the year in 2010.¹ Belonging to the aminoglycoside family of antibiotics, neomycin is known as a stable, water-soluble antibiotic.² It has numerous clinical applications, which include topical formulations to prevent or treat superficial infections, as a solution for urinary instillation to prevent catheter-associated bacteriuria, and in peritoneal irrigation solutions, dental pastes, and vaccines to prevent bacterial growth.¹ Given its wide use, it is not surprising that neomycin is among the most frequently reported allergens that generate positive patch test responses.²

Although neomycin sensitization rates in Europe have dropped, they were higher in the past. A Croatian study from 1993 found that neomycin sensitization gradually increased from 1990 to 1992, from 5% to 10.2%.³ A Portuguese study from 1991 produced similar results, with researchers finding that among 562 children, 18.4% had positive patch test results to neomycin.⁴ In a study from 2005 of 47,559 patients from the Information Network of Departments of Dermatology, 2.5% of patients had positive patch test results to neomycin

sulfate.⁵ Studies from major European centers from 1996 to 2006 reported neomycin sensitization rates varying from 1.1% to 3.8% and averaging approximately 2.6%.^{1,6} Among the general German population, it was estimated that 22 to 29 persons per 100,000 were allergic to neomycin.⁷ Similarly, in a British study, it was found that among topical antibiotics, sensitization to neomycin was the most common at 3.6%, followed by clioquinol, and fusidic acid.⁸ Of the topical medications, neomycin is considered a moderate sensitizer, while fusidic acid and clioquinol are considered weak sensitizers, which likely influences the at least historically higher rates of

¹Division of Dermatology, Departments of Medicine & Medical Microbiology and Immunology, University of Alberta, Edmonton, AB, Canada

²Division of Clinical Dermatology & Cutaneous Science, Department of Medicine, Dalhousie University, Halifax, NS, Canada

³Department of Dermatology and Skin Science, University of British Columbia, Vancouver, BC, Canada

Corresponding Author:

Dr. John F. Elliott, University of Alberta, Division of Dermatology,
2-166 Clinical Sciences Building, Edmonton, AB T6G 2G3,
Canada.

Email: john.elliott@ualberta.ca

sensitization to neomycin.⁸ The striking change in neomycin sensitization rates may be influenced largely by the reduced availability of neomycin products in Europe.

In contrast to Europe, neomycin has consistently been reported by the North American Contact Dermatitis Group (NACDG) to be among the top 5 allergens, with sensitization rates ranging from 7% to 13% over the past 2 decades.⁹⁻¹⁴ In fact, the NACDG reported the prevalence of neomycin sensitization at 10% during 2005 and 2006, ranking it fifth among the 15 most common allergens.¹¹ In the United States, neomycin sensitization rates averaged 11.4%.⁶ These rates are considerably higher compared with rates reported in the 1970s (Table 1). Contrastingly, a retrospective chart review of patch test patients from Ottawa, Ontario, Canada, published in 2012 showed that among 100 patients found to be allergic to 1 or more topical medications, 29 were sensitized to neomycin, compared with 44 who were sensitized to bacitracin.³⁴

Given the temporal and regional variation in neomycin sensitization rates worldwide, our study is the first to analyze the rates among patch test centers in western Canada and compare them with a survey of the literature (Table 1). It is thought that the use of triple-antibiotic topical products, readily available as over-the-counter preparations and use in higher risk patients (such as those with leg ulcers, stasis dermatitis, otitis externa, and anogenital dermatitis) appear to influence the rise in neomycin sensitization rates in North America.^{1,35}

Methods

Data Selection

We used separate patch test patient databases in the 3 divisions of dermatology, including the University of British Columbia (UBC), the University of Alberta (UofA), and the University of Saskatchewan (UofS). All patients were >18 years of age, and all data were anonymized prior to analysis. A total of 5690 patients met our criteria and formed the study cohort (Table 2). Data were available from 2001 to 2005 and from 2007 to 2013 from UofS. Data for 2006 were not available, as no patch testing was done during that year in Saskatchewan. The UBC and UofA databases included patch testing data from 2009 to 2013. Our data were compared with the available published data for neomycin sensitization rates from the NACDG.⁹⁻¹⁴ Rating of the patch test reaction was according to the International Contact Dermatitis Research Group scoring system. A Medline search was done from 1970 to the present to locate neomycin sensitization studies (Table 1).

Statistical Analysis

A variety of statistical analysis were performed, including collectively analyzing all the data as well as individually

analyzing each site and study interval period. Descriptive statistics, prevalence rates, trend-line regression analysis, and risk estimates were determined. Analysis of variance (ANOVA) with post hoc least significant difference testing was used to compare positive test results between different centers. Chi-square tests for independence were performed to determine whether gender, location, and year were related to patch test results. Statistical analyses were performed using SPSS version 20 (IBM).

Results

Descriptive Statistics

The mean age of patients who showed positive (ie, $\geq 1+$) reactions to neomycin was 49.5 years (95% confidence interval, 47.3-51.7 years), with a gender predominance of women (82.1%) and men representing 17.9% of our study population. The majority of patients were between 40 and 50 years of age. The prevalence rate for neomycin-positive patch tests overall was 2.95% from 2001 to 2013, and in particular, from 2001 to 2008, the rate was 7.37% (data available only for the UofS), and from 2009 to 2013, the rate was 1.76% (data available for all 3 centers). Prevalence rates were calculated separately for each site (Table 1), and it was found that at the UofS, the rates were 7.37% (2001-2008) and 1.66% (2009-2013); at the UofA, the rate was 1.44% (2009-2013); and at the UBC, the rate was 2.08% (2009-2013).

Overall Trend Analysis

Overall for all sites, it was found that neomycin sensitization decreased at a rate of 0.89% per year from 2001 to 2013 ($R^2 = 0.75$). ANOVA confirmed that the rate of decrease was statistically significant ($P < .001$). Further analysis indicated that from 2001 to 2008 (data available for the UofS only), the rate of decrease was 1.16% per year ($R^2 = 0.59$, $P = .043$), and from 2009 to 2013 (data available from all 3 centers), the rate became nearly constant for neomycin sensitization, with a change of only 0.01% per year ($R^2 = 0.0037$; the line is essentially flat) (Figures 1A and 1B). These rates were compared with the published NACDG reported rates, which averaged 10.58% and 8.90% for 2001 to 2008 and 2009 to 2012, respectively (Table 2).

Site-Specific Trend Analysis

At UBC, the rate of sensitization showed a slight positive trend at 0.31% per year ($R^2 = 0.22$, $P = .426$), whereas at UofA there was a slight negative trend at 0.24% per year ($R^2 = 0.52$, $P = .169$). Neither of these trends was statistically significant.

At UofS, there was a significant negative trend from 2001 to 2008 of 1.16% per year ($R^2 = 0.59$, $P = .043$), while the results showed no significant trend (0.035% per year; $R^2 = 0.011$, $P = .867$) for 2009 to 2013.

Table 1. Neomycin Sensitization Rates Since 1970: A Survey of the Literature.

Year (Journal)	Author(s)	Study	Rate of Neomycin Sensitization	Sample Size/Comments	Location
1970 (<i>Archives of Dermatology</i>)	Patrick et al ¹⁵	"Neomycin Sensitivity in the Normal (Nonatopic) Individual"	8%*	100	North America (New Orleans)
1973 (<i>Archives of Dermatology</i>)	Rudner et al ¹⁶	"Epidemiology of Contact Dermatitis in North America: 1972"	6%*	1200	North America
1973 (<i>Archives of Dermatology</i>)	Baer and Ramsey ¹⁷	"The Most Common Contact Allergens 1968-1970"	5.2%†	200 (1968-1970)	North America (New York University)
1976 (<i>Contact Dermatitis</i>)	Carruthers and Cronin ¹⁸	"Incidence of Neomycin and Framycetin Sensitivity"	5.1%*	450	Europe (St. John's Hospital, London, UK)
1977 (<i>Contact Dermatitis</i>)	Husain ¹⁹	"Contact Dermatitis in the West of Scotland"	6.9%‡	1312 (ages 12-74 y)	Europe (western Scotland)
1979 (<i>Archives of Dermatology</i>)	Prystowsky et al ²⁰	"Allergic Contact Hypersensitivity to Nickel, Neomycin, Ethylenediamine, and Benzocaine"	1.1%‡	1158§	North America (San Francisco area)
1979 (<i>JAMA</i>)	Leyden and Kligman ²¹	"Contact Dermatitis to Neomycin Sulfate"	0.09%†	2175	North America
1991 (<i>Contact Dermatitis</i>)	Barros et al ⁴	"Patch Testing in Children: A Study of 562 School Children"	18.4%*	562 children (mean age, 8.14 y)	Europe (Portugal)
1993 (<i>Archives of Industrial Hygiene and Toxicology</i>)	Lipozencić et al ³	"Neomycin—A Frequent Contact Allergen"	1990: 5%* 1991: 7.7%* 1992: 10.2%* 2000: 2.9%*	1381 (1990-1992)	Europe (Croatia)
2003 (<i>British Journal of Dermatology</i>)	Britton et al ²²	"The British Standard Series of Contact Dermatitis Allergens: Validation in Clinical Practice and Value for Clinical Governance"		3062	UK (7 centers)
2005 (<i>Pharmacoepidemiology and Drug Safety</i>)	Menezes de Pádua et al ⁵	"Contact Allergy to Neomycin Sulfate: Results of a Multifactorial Analysis"	2.5%*	47,559 (from the IVDK)	Europe (Germany, Austria, Switzerland)
2005 (<i>Contact Dermatitis</i>)	Machovcova et al ²³	"Common Contact Sensitizers in the Czech Republic. Patch Test Results in 12,058 Patients With Suspected Contact Dermatitis"	1997-2001: 1.9%*	12,058	Patch test results from 9 clinics in the Czech Republic
2005 (<i>Der Hautarzt</i>)	Worm et al ²⁴	"Epikutantestung mit der DKG-Standardreihe 2001-2004"	2001-2004: 2.3%*	31,973	Report current trends from Germany, Austria, and Switzerland
2005 (<i>Contact Dermatitis</i>)	Uter et al ²⁵	"The European Standard Series in 9 European Countries, 2002/2003—First Results of the European Surveillance System on Contact Allergies"	2002-2003: 2.9%*	9672	ESSCA (9 European countries, 17 centers)
2005 (<i>Contact Dermatitis</i>)	Hasan et al ²⁶	"Patch Test Reactions to Cosmetic Allergens in 1995-1997 and 2000-2002 in Finland—A Multicentre Study."	2000-2002: 5.4%*	11,662	Finnish Contact Dermatitis Group (7 clinics)
2005 (<i>Contact Dermatitis</i>)	Bruynzeel et al ²⁷	"Monitoring the European Standard Series in 10 Centres 1996-2000."	1996-2000: 3.0%*	26,210	Europe (8 countries, 10 centers)
2007 (<i>Contact Dermatitis</i>)	Lindberg et al ²⁸	"Time Trends in Swedish Patch test Data From 1992 to 2000. A Multicenter Study Based on Age- and Sex-Adjusted Results of the Swedish Standard Series"	1992: 1.9%* 2000: 1.2%*	3662 3790	9 Swedish centers

(continued)

Table 1. (continued)

Year (Journal)	Author(s)	Study	Rate of Neomycin Sensitization	Sample Size/ Comments	Location
2008 (<i>Contact Dermatitis</i>)	Nguyen et al ²⁹	"Prevalence of Patch Test Results From 1970 to 2002 in a Multi-Centre Population in North America (NACDG)"	1974-1975: 6.4% [‡] 1975-1976: 5.6% [‡] 1984-1985: 6.6% [‡] 1985-1989: 7.2% [‡] 1992-1994: 9.0% [‡] 1994-1996: 11.6% [‡] 1996-1998: 13.1% [*] 1998-2000: 11.5% [*] 2001-2002: 11.4% [*] 2001-2005: 11.8% [‡]	1900 1500 1199 3983 3518 3104 3436 5822 4517 3834	North America (NACDG)
2008 (<i>Archives of Dermatology</i>)	Davis et al ³⁰	"Changing Trends and Allergens in the Patch Test Standard Series. A Mayo Clinic 5-Year Retrospective Review, January 1, 2001, Through December 31, 2005"			Patch testing clinic at Mayo Clinic
2008 (<i>Dermatitis</i>)	Warshaw et al ¹⁰	"NACDG Patch-Test Results, 2003-2004 Study Period"	2003-2004: 10.6% [*]	5148	North America (NACDG)
2008 (<i>Journal of the European Academy of Dermatology and Venerology</i>)	Hegewald et al ³¹	"The European Surveillance System of Contact Allergies (ESSCA): Results of Patch Testing the Standard Series, 2004"	2004: 2.2% [*]	9988	ESSCA (11 European countries)
2009 (<i>Dermatitis</i>)	Zug et al ¹¹	"Patch-Test Results of the NACDG 2005-2006"	2005-2006: 10.0% [*]	4439	North America (NACDG)
2009 (<i>Contact Dermatitis</i>)	Uter et al ³²	"The European Baseline Series in 10 European Countries, 2005/2006: Results of the European Surveillance System on Contact Allergies (ESSCA)"	2005-2006 Western: 1.9% [*] Southern: 1.4% [*] Central: 1.1% [*] Northeast: 3.8% [*]	8544 2666 3239 1598	ESSCA (10 European countries)
2010 (<i>Contact Dermatitis</i>)	De Groot et al ⁶	"Frequency of Sensitization to Common Allergens: Comparison Between Europe and the USA"	US mean, 11.4% European mean, 2.6% [*]	Meta-analysis of routinely tested allergens at large centers	North America vs Europe
2012 (<i>Acta Dermatovenerologica Croatica</i>)	Machovcova ³³	"The Frequency of Contact Allergy in Children and Adolescents in the Czech Republic"	11.5% [*]	218 schoolchildren, 2005-2006 (mean age, 12.6 y)	Czech Republic (Prague)

IVDK, Information Network of Departments of Dermatology; NACDG, North American Contact Dermatitis Group.

[‡]Neomycin sulfate 20%, petrolatum.

^{*}Neomycin sulfate 20%, aqueous.

[‡]Neomycin sulfate 20%, unknown vehicle.

[‡]Paid "normal" adult volunteers.

[‡]Diagnosis of allergic contact dermatitis in 1.1%.

Table 2. Prevalence Rates for Neomycin Sensitization.

Location	Years	Sample Size	Patients Positive to Neomycin (%)
Western Canada (data available from UofS only)	2001-2008	1207	7.37
Western Canada (data available from UBC, UofA, and UofS)	2009-2013	4485	1.73
NACDG ⁹⁻¹⁴	2001-2008	19,600	10.58
	2009-2012	8546	8.90
Europe (De Groot and Maibach ⁶)	1997-2006	128,124	2.60

NACDG, North American Contact Dermatitis Group; UBC, University of British Columbia; UofA, University of Alberta; UofS, University of Saskatchewan.

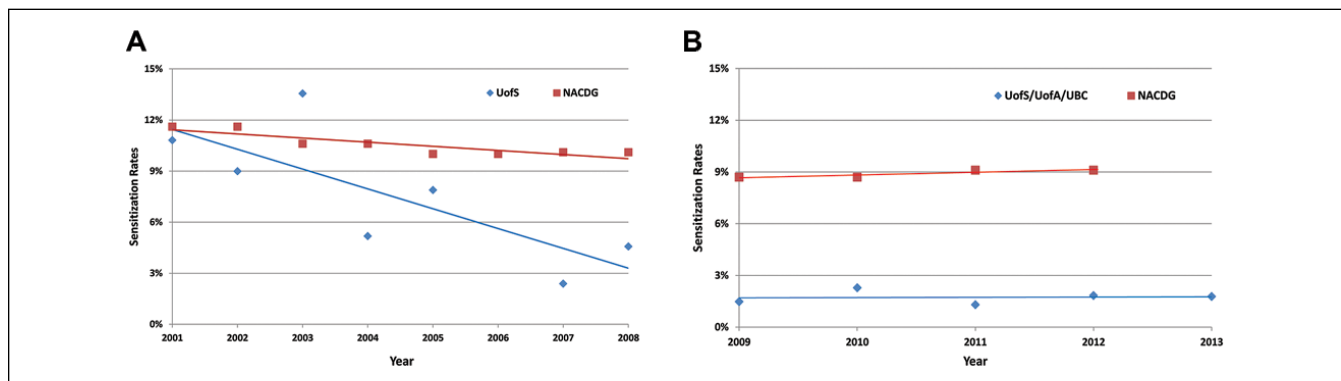


Figure 1. (A) Neomycin sensitization rates from 2001 to 2008 for the North American Contact Dermatitis Group (NACDG) compared with the University of Saskatchewan (UofS). Between 2001 and 2008, neomycin sensitization rates decreased by 1.16% per year ($R^2 = 0.59$, $P = .043$) at the UofS and by 0.24% per year ($R^2 = 0.77$, $P = .004$) for the NACDG. (B) Neomycin sensitization rates from 2009 to 2013 at the UofS, University of Alberta (UofA), and University of British Columbia (UBC) compared with available data from the NACDG. Between 2009 and 2013, neomycin sensitization rates were low and almost constant in western Canada. Rates among UofS, UofA, and UBC were not significantly different ($P = .074$) but were significantly different from that of the NACDG ($P = .037$).

Post Hoc Analysis (ANOVA)

ANOVA was performed to determine the effects of region, location, and time period on neomycin sensitization. In Saskatchewan, there was a statistically significant difference in neomycin sensitization rates between 2001 to 2008 and 2009 to 2013 ($F_{1,12} = 11.5$; $P = .007$). Post hoc least significant difference contrast testing (with α set at $P < .05$) indicated that overall, the UofS had the largest number of positive neomycin patch tests, followed by UBC and then UofA ($P < .001$). However, UofA and UBC sensitization rates did not significantly differ ($P = .281$). For 2009 to 2013, location did not significantly affect neomycin sensitization rates ($P = .587$).

Chi-Square Test

We analyzed our patch test population on the basis of the published literature, which suggests that the majority of the patch testing population is female (62% vs 38%).³⁶ A χ^2 test was performed, and a significant relationship was found between patch test results and gender, $\chi^2(2, N = 5690) = 28.22$, $P < .001$.

Relative Risk

Relative risk estimates showed that women were approximately 2.75 times more likely to have positive patch test results to neomycin than men (relative risk, 2.748; 95% confidence interval, 1.858-4.064).

Discussion

Our results indicate that overall, neomycin sensitization has been decreasing in western Canada. This trend is statistically significant and appears to correlate with the inability to find neomycin-related products over the counter in Canada. Interestingly, within western Canada, the rates of neomycin sensitization were distinct at each site. The higher rate of sensitization from UBC (2.08%) may be related to geographic proximity to the United States and the potential for frequent visits. ANOVA showed that within Saskatchewan, neomycin sensitization rates were significantly different between 2001 to 2008 and 2009 to 2013 ($F_{1,12} = 11.5$; $P = .007$). However, the neomycin sensitization rates from 2009 to 2013 at all 3 sites becomes statistically insignificant. Our analyses suggest

a downward trend for neomycin sensitization, and in particular stabilization in neomycin sensitization rates (0.01% per year; $R^2 = 0.0037$, slope = .0001) (Figure 1B). Chi-square analysis found that year was a statistically significant factor in neomycin sensitization. These findings coincide with those of previous studies demonstrating stabilization in neomycin sensitization rates in Europe.⁶

The literature suggests that positive patch test results are more common in women than men. The χ^2 test revealed increased neomycin sensitization rates in women compared with men ($P < .05$). Our study demonstrated that women were approximately 2.75 times more likely to have positive patch test results than men (relative risk, 2.75; 95% confidence interval, 1.86-4.06). Perhaps women are more likely to be compliant with topical medicaments and are therefore at increased risk for neomycin sensitization. UofS was found to have the largest number of positive neomycin patch test results (because of the historically higher rate), followed by UBC and then UofA, and this difference was statistically significant. However, the likelihood of a negative patch test result to neomycin appears to be similar at all 3 sites.

In our retrospective study, we found that neomycin sensitization rates are decreasing in western Canada (2001-2013) and in fact parallel trends in Europe, where the average rate of sensitization has been approximated at 1.9% or 2.6% per year (Table 1). Regional variation in the availability of topical products is likely a factor in these results. Although neomycin is found in vaccines, studies have shown that the concentration present (25 μg) is unlikely sufficient to cause sensitization, as 100 to 1000 μg is typically required to cause sensitization.³⁷ Other factors that affect the availability of neomycin are prescribing trends, such as the use of triple-antibiotic ointments, which may inadvertently be influencing the likelihood of exposure to neomycin in the United States. The structural composition of neomycin likely contributes to its higher sensitization potential, compared with other topical antibiotics.

At present in Canada, there appears to be a reduction in products containing neomycin. On the basis of a Health Canada search, we found that many products containing neomycin have been discontinued. It is hard to ascertain why these products were removed, but one may postulate that sensitization may have contributed to the removal of such products from this particular market.

Conclusions

Neomycin sensitization in western Canada (and probably all of Canada) has decreased substantially and is now stabilizing. The decrease in sensitization rates is likely influenced by a reduction in over-the-counter products, prescribing trends, and reduced availability of neomycin-containing products. Moreover, there seems to be a gradual reduction in the percentage of neomycin sensitization reported by the NACDG in recent years, which may be influenced by the increased representation of Canadian patients within the NACDG cohorts. Canadian investigators contribute at least one-third of the NACDG data. Therefore, the

actual rate of sensitization in the United States is probably greater than the $\pm 10\%$ to 13% reported in NACDG publications.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

References

1. Sasseville D. Neomycin. *Dermatitis*. 2010;21(1):3-7.
2. Bjarnason B, Flosadottir E. Patch testing with neomycin sulphate. *Contact Dermatitis*. 2000;43(5):295-302.
3. Lipozencić JI, Milavec-Puretić V, Trajković S. Neomycin—a frequent contact allergen. *Arh Hig Rada Toksikol*. 1993;44(2):173-80.
4. Barros MA, Baptista A, Correia TM, et al. Patch testing in children: a study of 562 school children. *Contact Dermatitis*. 1991;25(3):156-9.
5. Menezes de Pádua CA, Schnuch A, Lessmann H, et al. Contact allergy to neomycin sulfate: results of a multifactorial analysis. *Pharmacoepidemiol Drug Saf*. 2005;14(10):725-33.
6. De Groot AC, Maibach HI. Frequency of sensitization to common allergens: comparison between Europe and the USA. *Contact Dermatitis*. 2010;62(6):325-9.
7. Menezes de Pádua CA, Uter W, Schnuch A. Contact allergy to topical drugs: prevalence in a clinical setting and estimation of frequency at the population level. *Pharmacoepidemiol Drug Saf*. 2007;16(4):377-384.
8. Morris SD, Rycroft RJG, White IR, Wakelin SH, McFadden JP. Comparative frequency of patch test reactions to topical antibiotics. *Br J Dermatol*. 2002;146(6):1047-51.
9. Pratt MD, Belsito DV, DeLeo VA, et al. North American Contact Dermatitis Group patch-test results, 2001-2002 study period. *Dermatitis*. 2004;15(4):176-83.
10. Warshaw EM, Belsito DV, DeLeo VA, et al. North American Contact Dermatitis Group patch-test results, 2003-2004 study period. *Dermatitis*. 2008;19(3):129-36.
11. Zug KA, Warshaw EM, Fowler JF Jr, et al. Patch-test results of the North American Contact Dermatitis Group 2005-2006. *Dermatitis*. 2009;20(3):149-60.
12. Fransway AF, Zug KA, Belsito DV, et al. North American Contact Dermatitis Group patch-test results for 2007-2008. *Dermatitis*. 2013;24(1):10-21.
13. Warshaw EM, Belsito DV, Taylor JS, et al. North American Contact Dermatitis Group patch-test results: 2009-2010. *Dermatitis*. 2013;24(2):50-9.
14. Warshaw EM, Maibach HI, Taylor JS, et al. North American contact dermatitis group patch test results: 2011-2012. *Dermatitis*. 2015;26(1):49-59.
15. Patrick J, Panzer JD, Derbes VJ. Neomycin sensitivity in the normal (nonatopic) individual. *JAMA Dermatol*. 1970;102(5):532-5.
16. Rudner EJ, Clendenning WE, Epstein E, et al. Epidemiology of contact dermatitis in North America: 1972. *Arch Dermatol*. 1973;108(4):537-40.
17. Baer RL, Ramsey DL. The most common contact allergens 1968-1970. *Arch Dermatol*. 1973;108(1):74-8.

18. Carruthers JA, Cronin E. Incidence of neomycin and framycetin sensitivity. *Contact Dermatitis*. 1976;2(5):269-70.
19. Husain SL. Contact dermatitis in the west of Scotland. *Contact Dermatitis*. 1977;3(6):327-32.
20. Prystowsky SD, Allen AM, Smith RW, et al. Allergic contact hypersensitivity to nickel, neomycin, ethylenediamine, and benzocaine. *Arch Dermatol*. 1979;115(8):959-62.
21. Leyden JJ, Kligman AM. Contact dermatitis to neomycin sulfate. *JAMA*. 1979;242(12):1276-8.
22. Britton JE, Wilkinson SM, English JS, et al. The British standard series of contact dermatitis allergens: validation in clinical practice and value for clinical governance. *Br J Dermatol*. 2003;148(2):259-64.
23. Machovcova A, Dastychova E, Kostalova D, et al. Common contact sensitizers in the Czech Republic. Patch test results in 12,058 patients with suspected contact dermatitis. *Contact Dermatitis*. 2005;53(3):162-6.
24. Worm M, Brasch J, Geier J, et al. Epikutantestung mit der DKG-Standardreihe 2001-2004. *Der Hautarzt*. 2005;56(12):1114-24.
25. Uter W, Hegewald J, Aberer W, et al. The European standard series in 9 European countries, 2002/2003—first results of the European Surveillance System on Contact Allergies. *Contact Dermatitis*. 2005;53(3):136-45.
26. Hasan T, Rantanen T, Alanko K, et al. Patch test reactions to cosmetic allergens in 1995-1997 and 2000-2002 in Finland—a multicentre study. *Contact Dermatitis*. 2005;53(1):40-5.
27. Bruynzeel DP, Diepgen TL, Andersen KE, et al. Monitoring the European Standard Series in 10 centres 1996-2000. *Contact Dermatitis*. 2005;53(3):146-9.
28. Lindberg M, Edman B, Fischer T, et al. Time trends in Swedish patch test data from 1992 to 2000. A multicenter study based on age- and sex-adjusted results of the Swedish standard series. *Contact Dermatitis*. 2007;56(4):205-10.
29. Nguyen SH, Dang TP, MacPherson C, et al. Prevalence of patch test results from 1970 to 2002 in a multi-centre population in North America (NACDG). *Contact Dermatitis*. 2008;58(2):101-6.
30. Davis MD, Scalf LA, Yiannias JA, et al. Changing trends and allergens in the patch test standard series. A Mayo Clinic 5-year retrospective review, January 1, 2001, through December 31, 2005. *Arch Dermatol*. 2008;144(1):67-72.
31. Hegewald J, Uter W, Aberer W, et al. The European Surveillance System of Contact Allergies (ESSCA): results of patch testing the standard series, 2004. *J Eur Acad Dermatol Venereol*. 2008;22(2):174-81.
32. Uter W, Rääsch C, Aberer W, et al. The European baseline series in 10 European Countries, 2005/2006 results of the European Surveillance System on Contact Allergies (ESSCA). *Contact Dermatitis*. 2009;61(1):31-8.
33. Machovcova A. The frequency of contact allergy in children and adolescents in the Czech Republic. *Acta Dermatovenerol Croat*. 2012;20(2):75-9.
34. Spring S, Pratt M, Chaplin A. Contact dermatitis to topical medicaments: a retrospective chart review from the Ottawa Hospital patch test clinic. *Dermatitis*. 2012;23(5):210-3.
35. Gehrig KA, Warshaw EM. Allergic contact dermatitis to topical antibiotics: Epidemiology, responsible allergens, and management. *J Am Acad Dermatol*. 2008;58(1):1-21.
36. DeLeo VA, Taylor SC, Belsito DV, et al. The effect of race and ethnicity on patch test results. *J Am Acad Dermatol*. 2002;46(2 Suppl):S107-12.
37. Rietschel RL. Neomycin sensitivity and the MMR vaccine. *JAMA*. 1981;245(6):571.

English Language Editing

JCMS is an English language journal and submissions must be presented in a style and grammar consistent with the highest standards of English publications. Although work described in a manuscript may be relevant and appropriate for consideration in our journal, if the manuscript suffers from insufficient English editing, it will be returned to the authors with the suggestion to first seek assistance either from a colleague whose first language is English or from a professional language service. SAGE Publications also offers resources in this area; please visit <http://languageservices.sagepub.com/en/> for more information.