

## Consumer Behaviour Among Nickel-allergic Patients

Malin G. AHLSTRÖM, Jacob P. THYSSEN, Torkil MENNÉ and Jeanne D. JOHANSEN

National Allergy Research Centre, Department of Dermatology and Allergy, Herlev and Gentofte Hospital, University of Copenhagen, DK-2900 Hellerup, Denmark. E-mail: malin.glindvad.ahlstroem.01@regionh.dk

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European Union (EU) regulation regarding the release of nickel from some metallic items intended for prolonged contact with the skin have been in place since 2000. Despite these regulations, studies from some EU countries have repeatedly demonstrated high levels of nickel release from metallic items covered by the EU Directive (1–10). In Denmark, Sweden and the Netherlands, such items were frequently found in street markets, but not commonly in chain stores (6–8). However, it is not known whether the high proportion of nickel-releasing items found in these studies is a problem for people with nickel allergy, and whether these people take prophylactic action to avoid nickel in everyday living. This paper describes self-reported consumer behaviour regarding metallic items and the severity of allergic nickel dermatitis in nickel-allergic patients from a Danish tertiary dermatology clinic.

### METHODS

A questionnaire was sent to 524 patients who had a positive patch-test reaction to nickel sulphate 5% pet. (Trolab, Smartpractice-Almirall Hermal, Reinbek, Germany) within the past 5 years (1 January 2010 to 31 December 2014) at the Department of Dermatology and Allergy, Herlev and Gentofte Hospital. The European baseline series had been used for patch-testing and readings were performed according to European Society of Contact Dermatitis (ESCD) guidelines (11) on day (D) 2, D3 or D4 and D7. Further details of the study methods have been published elsewhere. The study was reported to the Regional Ethics Committee of Copenhagen (H-15010935), and approved by the Data Protection Agency. Questions and possible response options that addressed the self-reported severity of allergic nickel dermatitis and consumer behaviour regarding purchase and use of metallic items are shown in Table S1<sup>†</sup>. The visual analogue scale (VAS) (range: 0–10) was used for questions regarding the severity of dermatitis and the difficulty of avoiding nickel. Statistical analyses for dichotomous variables were performed with the  $\chi^2$  test. Age-adjusted patch-test reactivity in groups was tested by logistic regression analysis. We tested whether self-reported current severity of allergic nickel dermatitis differed between those who reported that they had tried to avoid nickel by specific actions and those who had not by Mann-Whitney test. Age-grouping was performed according to their age when responding to the questionnaire: <40 vs.  $\geq$ 40 years. The level of significance was set at  $p < 0.05$ . Statistical analyses were performed with SAS, Version 9.4 for Windows (SAS Institute Inc., Cary, NC, USA) and graphs with GRAPHPAD PRISM version 6.07 for Windows (GraphPad Software, La Jolla, CA, USA).

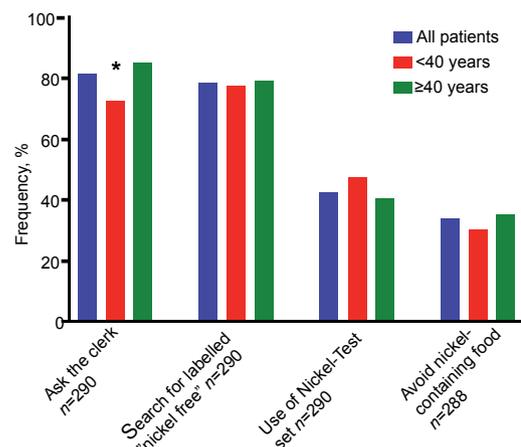
### RESULTS

The overall response rate to the questionnaire was 63.2%, corresponding to 342 patients (318 women and 24 men). Out of the total of 342 patients 292 (85.4%) gave an af-

firmative response to the question: “Have you ever had dermatitis after skin contact with shiny metallic items such as earrings or ear studs, watches, buttons or metallic fastenings?” Patient characteristics, shown in Table SII<sup>†</sup>, are further described elsewhere (12). This population differed from that of the previous, due to missing values in 2 patients.

Of these 292 patients, 205 (70.7%) stated that they always tried to avoid metallic items to which they were allergic, and significantly more of these patients were aged  $\geq$ 40 years ( $p = 0.03$ ). There were no differences in the age-adjusted patch-test reactivity between those who reported always avoiding metallic items compared with those who stated “not to”, or “not always to” avoid metallic items. On a VAS scale, 167 (58.6%) patients reported that it was easy to avoid nickel (VAS: 0–3), 66 (23.2%) moderately difficult (VAS: 4–7) and 52 (18.2%) reported that it was difficult (VAS: 8–10). There was no evidence that age affected the difficulty of avoiding metallic items ( $p = 0.125$ ). Patients were asked whether they had ever taken specific actions to avoid nickel in everyday life (Fig. 1). They reported that: “they had asked the clerk if a product they wanted to buy contained nickel” (81.7%), “they had searched for products labelled ‘nickel free’” (78.6%), “they had used a nickel test set” (42.4%) and that “they had avoided food containing nickel” (34.0%). Patients aged  $\geq$ 40 years were more prone than younger patients to have asked the clerk ( $p = 0.01$ ).

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**Fig. 1. Self-reported consumer actions to avoid nickel among patients with nickel allergy, stratified by age.** Patients often reported more than one action.  $\chi^2$  test was used to test differences between patients aged  $\geq$ 40 years and <40 years. \* $p < 0.05$ .

The self-reported current severity of allergic nickel dermatitis differed between those who reported that they had tried to avoid nickel by specific actions and those who had not (Fig. S1<sup>1</sup>). There was a significantly higher self-reported severity of current dermatitis in patients who had asked the clerk if a product they wanted to buy contained nickel (mean VAS: 4.6 vs. 3.5,  $p=0.026$ ), in those who had searched for products labelled “nickel free” (mean VAS: 4.6 vs. 3.6,  $p=0.039$ ) and for those who had avoided nickel-containing food (mean VAS: 5.0 vs. 4.0,  $p=0.012$ ), while we found no evidence of an association between using a nickel-test and the severity of allergic nickel dermatitis (mean VAS: 4.8 vs. 4.1,  $p=0.064$ ).

Fig. S2<sup>1</sup> depicts the shop categories where patients reported purchasing their jewellery, stratified by age. Patients often reported more than one category. Mostly, nickel-allergic patients bought their jewellery in jewellery shops (84.3%). Patients aged <40 years more often reported buying jewellery in clothing shops ( $p<0.001$ ) and on the Internet ( $p<0.001$ ), but not more often in markets ( $p=0.055$ ). Overall, patients who reported purchasing jewellery in locations other than jewellery shops were more commonly aged <40 years ( $p<0.0001$ ).

## DISCUSSION

There was a high proportion (85.4%) of self-reported allergic nickel dermatitis among those who had performed a positive nickel patch-test at our hospital department. It was common for nickel-allergic patients to try to actively avoid nickel, using methods that may have been recommended by the dermatologist, and patients mostly purchased their jewellery in jewellery shops. In addition, a substantial proportion of patients at some point had tried to avoid nickel-containing food, which is no longer a general recommendation. Significantly worse self-reported allergic nickel dermatitis was found in patients who actively tried to avoid nickel compared with those who did not undertake any actions to avoid nickel. This could be because patients with more severe illness may be more likely to try to avoid nickel. Another explanation could be that the subjective severity of dermatitis differed between patients, with similar objective assessment of severity. However, the design of the study precludes conclusions regarding the casual relationship. Most patients found it easy to avoid nickel, but almost 20% reported that it was very difficult. Patients <40 years of age showed more risky behaviour, as they more often purchased jewellery outside of jewellery shops. This finding is in agreement with an earlier study, suggesting a higher risk of nickel exposure in young people (6). There was no control group included in this study, which could have given information about differences in consumer behaviour between patch-tested patients with and without nickel allergy. The questionnaire did not determine whether the metallic items were bought in an EU or a non-EU country, or the year of purchase.

However, a previous Danish study identifying metallic items causing dermatitis in nickel-allergic patients from the same hospital clinic as in the present study, found that items positive in a dimethylglyoxime (DMG) test were mainly purchased in an EU country after the introduction of the Danish regulation on nickel (5).

In conclusion, nickel-allergic patients from our hospital clinic tried to avoid nickel exposure, both through their choice of where to purchase jewellery, and by proactive actions when buying metallic items. Young patients aged <40 years more often purchased jewellery outside of jewellery shops. Severe self-reported allergic nickel dermatitis was associated with avoidance of nickel in everyday life.

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## REFERENCES

1. Byer TT, Morrell DS. Periumbilical allergic contact dermatitis: blue jeans or belt buckles? *Pediatr Dermatol* 2004; 21: 223–226.
2. Heim KE, McKean BA. Children's clothing fasteners as a potential source of exposure to releasable nickel ions. *Contact Dermatitis* 2009; 60: 100–105.
3. Garcia-Gavin J, Armario JC, Fernandez-Redondo V, Sanchez-Perez J, Silvestre JF, Perez-Perez L, et al. Nickel and cobalt release from earrings purchased in Spain. *Contact Dermatitis* 2012; 66 (Suppl. 2): 78.
4. Krecisz B, Chomiczewska D, Palczynski C, Kiec-Swierczynska M. Contact allergy to metals in adolescents. Nickel release from metal accessories 7 years after the implementation of the EU Nickel Directive in Poland. *Contact Dermatitis* 2012; 67: 270–276.
5. Thyssen JP, Menné T, Johansen JD. Identification of metallic items that caused nickel dermatitis in Danish patients. *Contact Dermatitis* 2010; 63: 151–156.
6. Thyssen JP, Menné T, Lidén C, White IR, White J, Spiewak R, et al. Excessive nickel release from earrings purchased from independent shops and street markets – a field study from Warsaw and London. *J Eur Acad Dermatol Venereol* 2011; 25: 1021–1026.
7. Biesterbos J, Yazar K, Lidén C. Nickel on the Dutch market: follow-up 10 years after entry into force of the EU Nickel Directive. *Contact Dermatitis* 2011; 65: 115–123.
8. Biesterbos J, Yazar K, Lidén C. Nickel on the Swedish market: follow-up 10 years after entry into force of the EU Nickel Directive. *Contact Dermatitis* 2010; 63: 333–339.
9. Lidén C, Norberg K. Nickel on the Swedish market. Follow-up after implementation of the Nickel Directive. *Contact Dermatitis* 2005; 52: 29–35.
10. Thyssen JP, Menné T, Johansen JD. Nickel release from inexpensive jewelry and hair clasps purchased in an EU country – are consumers sufficiently protected from nickel exposure? *Sci Total Environ* 2009; 407: 5315–5318.
11. Johansen JD, Aalto-Korte K, Agner T, Andersen KE, Bircher A, Bruze M, et al. European Society of Contact Dermatitis guideline for diagnostic patch testing – recommendations on best practice. *Contact Dermatitis* 2015; 73: 195–221.
12. Ahlström MG, Menné T, Thyssen JP, Johansen JD. Nickel allergy in a Danish population 25 years after the first nickel regulation. *Contact Dermatitis* 2017; 76: 325–332.