

Assessment of nickel release from earrings randomly purchased in China and Thailand using the dimethylglyoxime test

CARSTEN R. HAMANN¹, DATHAN J. HAMANN¹, QUINLAN J. HAMANN¹, CURTIS P. HAMANN², WARANYA BOONCHAI³, LIN-FENG LI⁴ AND JACOB P. THYSSSEN⁵

¹Calvin College, 3435 Burton SE, Grand Rapids, Michigan 49546, and ²SmartPractice, 3400 E. McDowell, Phoenix, Arizona 85008, USA, ³Department of Dermatology, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok 10700, Thailand, ⁴Department of Dermatology, Peking University Third Hospital, 49 N Garden Rd, Haidian District, Beijing 100083, China, and ⁵Department of Dermato-Allergology, Gentofte Hospital, University of Copenhagen, Hellerup 2900, Denmark

Background: China and Thailand produce large amounts of jewellery that are sold domestically and abroad.

Objective: To identify nickel release and metal content in earrings purchased in China and Thailand.

Methods: A total of 557 earrings were randomly purchased from vendors in 11 markets located in Beijing, Chengdu, Bangkok, Patong Beach, and Hat Yai. Earrings were subjected to dimethylglyoxime (DMG) tests and 26 of the DMG negative earrings were further evaluated qualitatively for major and minor metal content using X-ray fluorescence spectrometry.

Results: A total of 314 Chinese earrings (31.5%) and 243 Thai earrings (29.2%) were DMG test positive. Three (11.5%) of 29 DMG negative earrings contained nickel as a major component; 7 (26.9%) of 29 DMG negative earrings contained nickel as a minor component.

Discussion: Excessive nickel release was frequent. This may contribute to the high prevalence of nickel allergy in both countries. Increased public education together with the adoption of a regulatory intervention in Thailand may be warranted. In China, enforcement of the 2002 Chinese National Standard GB 11887 may assist in reducing sensitization. These initiatives may eventually result in decreased morbidity among the Chinese and Thai citizens, but can potentially benefit recipient countries of these important earring producing countries.

Key words: dimethylglyoxime test, earrings, nickel allergy, nickel release, prevalence, risk exposure, XRF spectrometry © John Wiley & Sons A/S, 2010.

Conflicts of interest: Carsten Hamann, Dathan J. Hamann, Quinlan J. Hamann, Waranya Boonchai, Lin-Feng Li, and Jacob P. Thyssen have no conflict of interests to declare. Curtis P. Hamann is the owner of SmartPractice, Arizona, USA, which sells patch test materials and dimethylglyoxime tests.

Accepted for publication 28 November 2009

Over the 20th century, nickel has been the most common contact allergen among patients with dermatitis and subjects from the general population in Western Europe and the United States (1–3). Although nickel is ubiquitous and many different sources of exposures may result in nickel allergy (4–6), the most important risk factor for

nickel allergy is ear piercing (7, 8). To prevent nickel allergy and dermatitis, the EU Nickel Directive dictated that nickel release from consumer products intended to be in prolonged skin contact should not exceed 0.5 µg/cm²/week (9). Since 2005, nickel release from piercing post assemblies (also called studs or posts) has been restricted to

0.2 $\mu\text{g}/\text{cm}^2/\text{week}$ replacing the former version dictating a limit on the nickel content (10). A convincing effect of regulatory intervention in European populations was recently shown among Danish women, as the prevalence of nickel allergy was significantly higher among women who were ear pierced before the Danish nickel regulation was introduced (15.6%) when compared with women who were ear pierced after (6.9%) (8). Despite further evidence for an effect of the Nickel Directive (3, 11–13), excessive nickel release ($> 0.5 \mu\text{g}/\text{cm}^2/\text{week}$) from jewellery remains common as recently shown in Denmark, Sweden, and Italy (12, 14, 15). These disturbing reports underscore the importance of random controls performed by national chemical inspection services to prevent violation of the Nickel Directive. In the United States, there is currently no regulation on nickel release from consumer products (16).

A recent patch test study showed that the prevalence of nickel allergy was 33.8% among Thai women (17). Each year, China and Thailand produce large amounts of jewellery that are sold domestically (both to their citizens and to foreign tourists), but also exported to Western Europe and the United States. There is currently no nickel regulation in Thailand, whereas China passed one in 2002. For the above reasons, it is interesting to focus on nickel exposure and nickel allergy in these countries. Thus, this study aimed to determine the prevalence of excessive nickel release from earrings randomly purchased at markets in China and Thailand.

Methods

Purchasing strategy

A total of 557 pairs of metallic earrings were randomly purchased from 11 different markets in 5 Asian cities (Beijing and Chengdu, China and Bangkok, Phuket, and Hat Yai, Thailand). Unlike vendors in Western jewellery stores, Thai and Chinese vendors often have highly variable yet negotiable opening prices, as bargaining is the primary form of price determination at many locations. We aimed to obtain the broadest representation of earrings in terms of price, colour, and style. Earrings were bought from multiple small vendors within each market. Attention was not placed on differentiating the targeted age group by each vendor but to the quantity and variability of earrings. An attempt was made not to purchase earrings that looked similar (e.g. identical metallic parts but with different coloured stones).

Description of markets and stores

In Beijing (population = 17 million), earrings were purchased from three distinct market areas: San Li Tun Market ($n = 77$), Hong Qiao Market ($n = 16$), and Silk Street Market ($n = 75$). The San Li Tun Market is a large multi-story freestanding building with hundreds of shops and vendors independently operated, each selling goods ranging from jewellery and cosmetics to tailored suits and lighters. The San Li Tun Market attracts mostly upper class Chinese customers and foreign tourists. The Hong Qiao Market is similarly situated in a large multi-story complex filled with separate stalls and stores. Known as the best place in China to buy pearls, Hong Qiao Market sells primarily higher-end more expensive earrings targeting a richer Chinese and foreign clientele. The Silk Street Market is Beijing's largest and most famous market. It is located near Tiananmen Square and caters to both Chinese and foreign customers.

In Chengdu (population = 10.5 million), earrings were purchased from three different market areas: the Chengdu International Supermarket ($n = 15$), Chengdu Northern Market ($n = 62$), and Chengdu Girls' Street ($n = 69$). The Chengdu International Supermarket caters almost exclusively to wealthy Chengdu residents and Chinese tourists. Situated in the richer southern district of Chengdu, the market is similar to a Western-style department store with name brand stores as well as local vendors and kiosks selling all kinds of clothing, jewellery, and fashion accessories. Chengdu Northern Market stretches over many kilometres selling everything from brooms and mops to furniture and pets. This market caters exclusively to poorer Chinese consumers and Chinese resellers and the price level was therefore very low, e.g. identical earrings seen at the Chengdu International Supermarket were available here at one third the price. Chengdu Girls' Street is located just one block from the city's centre and caters to the youth of Chengdu.

In Bangkok (population = 9 million), earrings were purchased from two different markets: the Central Silom Market ($n = 60$) and the Jatujak Market (JJ Market) ($n = 43$). Central Silom is located in a large multi-story mall on Bangkok's largest shopping street and holds both local and foreign vendors. Freestanding booths sell cheaper wares while established stores sell more expensive items. Overall, earrings from the Central Silom Market were the most expensive ones purchased for this study as the market mainly caters to upper class and wealthy Thai people. The Chatuchak Market caters to middle- and low-income Thai people as well as tourists and is Thailand's most famous outdoor weekend flea market. Earrings bought from this

market were either mass produced, second hand, or hand-made.

In the coastal district of Phuket (population = 1/4 million), earrings were purchased from seven different vendors in Patong Beach ($n = 58$). This shopping area is situated along the beach and stretches back into the city for more than a kilometre. Catering predominately to domestic and foreign tourists, the stores and stalls are filled with counterfeit luxury brands such as Gucci and Tiffany's. These items are often complete with fake packaging and gift bags.

In the southern city of Hat Yai (population = 200 000), we visited the Montril Road Market ($n = 30$) and the Choumrat Road Market ($n = 52$). The Montril Road Market caters exclusively to locals, with no foreigners to be seen. The Choumrat Road Market was also devoid of foreigners. A shift in style of the earrings away from the counterfeit Western brands in Phuket to those with a distinct Thai style was observed. The designs were targeted at the Thai youth, demonstrated by an obvious difference in clientele between the Patong Beach shopping area and the markets in Hat Yai. At the Montril Road Market earrings were also sold by the dozen, giving us the impression that resellers as well as individual consumers purchased earrings from this market. The most inexpensive earrings of all the markets in both China and Thailand were found here (available from approximately US\$ 0.20).

Dimethylglyoxime testing

Earrings were individually placed in zip-lock plastic bags and alphanumerically labelled. All earrings were tested at Mekos Laboratories, Hillerød, Denmark using a two-step dimethylglyoxime (DMG) spot test (AllertestTM Ni, Allerderm Laboratories, Phoenix, AZ, USA). One drop each of 1% DMG in alcohol and 10% ammonia hydroxide in water were placed on the tip of a white cotton applicator and were rubbed on the skin contacting a portion of the earrings for at least 20 seconds. It was then held against a white background and inspected for colour change. A pink colour change was recorded as a positive reaction ($>0.5 \mu\text{g}/\text{cm}^2/\text{week}$), whereas no colour change was recorded as a negative reaction. Earrings with a negative reaction that had visual evidence of surface discolouration from oxidation or other contamination were cleaned and the DMG test was repeated. Doubtful reactions, defined by discolouration of the cotton stick that was not pink, were registered as negative reactions.

X-ray fluorescence spectrometry

We randomly selected 26 DMG test negative earrings (Fig. 1) for additional qualitative analysis

using dispersive X-ray fluorescence (XRF) spectrometry. This was performed at Argen Corporation, San Diego, CA, USA. Earrings with clasps, posts, hooks, and any other metal and non-metal obstructions were cut into pieces prior to running scans on the skin contacting portions. Certain earrings were further sectioned in order to cover the 6-mm sample holder, which was used to analyse the material. Qualitative scans were run on each sample to determine the element composition using a Philips Dispersive X-ray Fluorescence Spectrometer (Model: MagiX; Type 708/96; serial number 496). Upon completion of each sample measurement, a spectral analysis was performed using IQ+ software version 3.0G. It programmatically identifies and labels the specific metal peaks. The dominant emissions were those with the highest peaks and these were labelled as major components in the chart. Metals with peak height of approximately half the dominant peaks were labelled as the minor metals. The morphology of the spectrometric footprints are easily recognizable as consistent with the base alloys available in the market identified in Table 2 as Monel, brass, bronze, and sterling silver.

Literature search

To estimate the prevalence of nickel allergy among clinical patients in Thailand and China, a comprehensive literature search was performed in medical journals accessible at www.pubmed.com but also in medical journals and text books printed in Chinese and Thai only. Search terms included contact dermatitis, nickel dermatitis contact allergy, nickel allergy, metals, patch testing, prevalence, China, Thailand, Hong Kong, and Taiwan.

Results

Metal analyses

The overall prevalence of positive DMG test reactions was 31.5% among 314 earrings purchased in China and 29.2% among 243 earrings purchased in Thailand (Table 1). The highest prevalence was found at the Chengdu International Supermarket in China (67.7%), whereas the lowest prevalence was found at the Chengdu Northern Market (12.9%).

XRF spectrometry was used to detect metal composition in 26 DMG test negative earrings that were randomly selected (Table 2 and Fig. 1). Analysis showed that nickel was a major metal component in 3 (11.5%) and a minor component in 7 (26.9%) of the 26 earrings examined. XRF spectrometry also showed that copper and zinc were the most predominant metals (19.2%).



Fig. 1. Twenty-six randomly selected dimethylglyoxime test negative earrings were examined for metal composition with X-ray fluorescence spectrometry.

Table 1. Assessment of nickel release using the dimethylglyoxime spot test on 557 earrings randomly purchased in China and Thailand

Country	City	ID	Market or shopping area	Number of earrings purchased at location	Dimethylglyoxime positive test reactions % (n =)
China					
	Beijing	A	San Li Tun Street	77	33.7 (26)
		B	Hong Qiao	16	37.5 (6)
		C	Silk Street	75	37.3 (28)
	Chengdu	D	Chengdu International Supermarket	15	66.7 (10)
		E	Northern	62	12.9 (8)
		F	Girls' Street	69	30.4 (21)
Total				314	31.5 (99)
Thailand					
	Bangkok	G	Central Silom	60	33.3 (20)
		H	Jatujak	43	34.9 (15)
	Phuket	J	Patong Beach	58	34.5 (20)
	Hatyai	K	Montril Road	30	13.3 (4)
		M	Choumrat Road	52	23.1 (12)
Total				243	29.2 (71)

Observations

In conversation with vendors, no reliable information on nickel content could be elucidated. Vendors had little or no knowledge of the true content of the metals present in their earrings, with most vendors insisting that their earrings were near or pure silver or gold. In the markets which offered earrings by the

dozen for purchase by resellers, similarities in the earring alloy components emerged. The clasps and hooks appeared to be made from the same alloy and bent into identical configurations before the attachment of the decorative suspended portion of the earring. Thousands of unique looking earrings from multiple vendors all had the same skin contacting posts, clasps, or hooks.

Table 2. Assessment of the metal composition in 26 randomly selected dimethylglyoxime test negative earrings using X-ray fluorescence (XRF) spectrometry

ID	Type of alloy	Plating	Colour	Components		Other alloys present
				Major*	Minor*	
A 7	Monel	Au	Gold	Cu, Ni	Zn	–
A 29	Brass	–	Grey	Cu	Zn, Fe	–
A 34	Monel	–	Silver	Cu, Ni	Sn, Pb, Cd	Solder
A 57	Copper	–	Copper	Cu	–	–
A 69	Monel	–	Grey	Cu	Ni, Fe	–
B 78	Monel	Au	Gold	Cu, Ni	–	–
C 93	Monel	–	Gold	Cu	Zn, Ni	–
C 125	Brass	Au	Gold	Cu, Zn	Sn	–
E 190	Brass	–	Gold	Cu, Zn	Ni	–
E 196	Bronze	–	Gold	Cu, Zn	Sn, Pb	–
F 244	Brass	Au	Gold	Cu	Zn, Fe	–
F 258	Bronze	–	Silver	Cu	Sn, Pb	–
F 304	Copper	–	Silver	Cu	Fe	–
F 308	Monel	–	Silver	Cu	Ni, Fe	–
G 321	Brass	–	Brass	Cu, Zn	Ni	–
G 329	Brass	–	Brass	Cu, Zn	Ni	–
G 353	Brass	–	Silver	Cu	Pb, Zn	Solder
G 355	Sterling silver	–	Silver	Ag	Cu	–
G 371	Copper	–	Silver	Cu	Fe	–
H 376	Brass	–	Silver/grey	Cu	Zn, Fe, Co, Sn	–
J 447	Brass	Au	Gold	Cu	Pb, Zn	Solder
J 459	Brass	–	Silver	Cu	Zn, Fe, Sn	–
J 469	Bronze	–	Silver	Cu	Sn, Ag, Pb	Sterling silver trim
K 496	Stainless steel	–	Silver	Fe, Cr	Ni	–
M 523	Stainless steel	–	Silver	Fe, Cr	Ni, Pb	Solder
M 533	Bronze	–	Silver	Cu	Fe, Sn	–

–, none; Ag, silver; Au, gold; Cd, cadmium; Cr, chromium; Cu, copper; Fe, iron; Ni, nickel; Pb, lead; Sn, tin; Zn, zinc.

*Results from the X-ray fluorescence spectrometry analysis are not given in percentages but only as an overall estimate. The dominant emissions are those with the highest peaks and are labelled as major components in the chart. Metals with peak height of approximately half the dominant peaks are labelled as the minor metals.

Prevalence of nickel allergy

The literature search showed that the median prevalence of nickel allergy among Chinese and Thai patients with dermatitis was 17.7% and 18.6%, respectively (Tables 3 and 4). Higher prevalences were generally observed among women in comparison to men; 20.6 % versus 16.6% in China and 9.1% versus 1.4% in Thailand (Table 3). Note that only two studies from Thailand reported patch test data from men.

Discussion

This study showed that approximately one third of 557 earrings randomly purchased in China and Thailand released an excessive amount of nickel as assessed by the DMG test (i.e. $>0.5 \mu\text{g}$ nickel/cm²/week) (Table 1). Hence, foreign tourists and locals that buy earrings from these markets are at risk of developing nickel allergy and dermatitis. No major difference in the prevalence of DMG positive test reactions was observed between the cities and markets we visited. However, as a result of the

inclusion criteria of not purchasing jewellery, which was visually identical to something previously purchased, a bias was introduced making comparisons between the markets difficult. With each successive market visited, familiar earrings were avoided even if they were more frequently observed for sale and a preference was given to items we had not seen before. Also, it is obviously difficult to compare the results from this study with those from similar DMG test studies performed elsewhere. Buying trends may vary depending on the investigator and the price level is different from one country to another. However, it seems that the prevalence of DMG positive reactions from earrings purchased in China and Thailand was comparable with the results obtained from a recent earring study performed in San Francisco, USA, where 30.7% of 277 earrings were DMG positive (50). There is currently no regulation of nickel exposure in the United States. Of note, the prevalence of positive DMG test reactions (14.7%) was considerably lower among 170 earrings recently purchased in Copenhagen, Denmark (15). In Stockholm, Sweden, the prevalence of DMG positive test reactions in jewellery was 23% before the

Table 3. Nickel patch test studies performed among patients in China (the list may not be exhaustive)

Author	References	Year	n*	Age (years)	Nickel patch test concentration (%) [†]	Patch test readings (day)	Prevalence of positive patch test reactions to nickel (%)		
							Total	Men	Women
Lee	(18)	1989	88	3–68	–	2, 4	15.9	–	–
Zhang	(19)	1991	124	–	–	2, 3	13.8	–	13.8
Wang	(20)	1994	88	18–67	–	–	16.0	–	–
Liu	(21)	1996	300	2–76	2.5	3	15.3	–	–
Lee	(22)	1996	256	–	–	2, 4	16.4	–	–
Liu	(23)	1997	1135	2–76	5	2, 3, 4	13.9	–	–
Xue	(24)	1997	720	15–70	5	1, 2	15.0	–	–
Chun	(25)	1997	84	–	5	1, 2, 3	7.1	–	–
Liu	(26)	1999	906	2–82	2.5	2, 3	20.9	–	–
Feng	(27)	2001	317	2–71	5	2	18.3	–	–
Li	(28)	2001	63	36.7 [‡]	–	2, 3	42.8	–	–
Li	(29)	2002	105	41.8 [‡]	–	2, 3	9.5	–	–
Li	(30)	2002	42	39.2 [‡]	–	2, 3	19.0	–	–
Li	(31)	2002	23	20–72	–	2, 3	8.7	0	8.7
Li	(32)	2003	14	20–60	–	2, 3	42.8	44.4	40
Li	(33)	2003	100	45.1 [‡]	TRUE Test [§]	2, 3	28.3	–	–
Li	(34)	2004	46	–	–	2, 3	30.4	–	–
Liu	(35)	2004	254	21–68	–	2, 3	48.5	–	–
Li	(33)	2004	181	41.8 [‡]	–	2, 3	25.8	–	–
Zhang	(36)	2005	108	18–86	–	2, 3	19.4	–	–
Fu	(37)	2006	530	5–82	–	2, 3	35.8	26.6	37.2
Zhao	(38)	2007	589	9–81	5	2	2.7	2.9	2.7
Wen	(39)	2007	100	48.1 [‡]	TRUE Test [§]	1, 2	33.3	–	–
Liu	(35)	2007	238	3–76	–	2, 3	10.5	–	–
Li	(40)	2007	655	39.9 [‡]	–	2, 3	26.1	–	–
Lam	(41)	2008	2585	–	–	2, 4	24.4	16.6	29.7
Mi	(42)	2008	1129	41 [‡]	–	2, 3	16.7	8.9	21.2
Cheng	(43)	2008	3559	¶	5	2, 3, 4**	17.7	79.4	20.6
Median prevalence							17.7	16.6	20.6

–, data not available.

*Number of patch tested patients.

[†]In petrotalum.[‡]Mean age.[§]The test concentration was 0.20 mg/cm², equivalent to 5%.[¶]Age distribution: 0–10 years 1.1%; 11–20 years 16.8%; 21–30 years 40.8%; 31–40 years 20.5%; 41–50 years 11.7%; 51–60 years 4.9%; 61–70 years 3.0%; > 71 years 1.1%.

**Patch test read at day 2 and 4 or at day 3.

Table 4. Nickel patch test studies performed among patients from Thailand (the list may not be exhaustive)

Author	References	Year	n *	Age (years)	Nickel patch test concentration [†] (%)	Patch test readings (day)	Prevalence of positive patch test reactions to nickel (%)		
							Total	Men	Women
Sunthonpalin	(44)	1979	300	–	2.5	–	10.5	1.4	9.1
Sunthonpalin	(45)	1982	630	–	–	–	12.5	12.2	12.7
Wongpiyabovorn	(46)	1996	150	–	–	2, 4	19.3	–	–
Sereaphinan	(47)	1997	115	–	–	2, 3, 4, 7	24.4	–	–
Wongpiyabovorn	(48)	2005	129	12–93	5	2, 3	18.6	–	–
Boonchai	(49)	2007	323	10–74	5	2, 3, 7	26.6	–	–
Median prevalence							18.6	1.4	9.1

–, data not available.

*Number of patch tested patients.

[†]In petrotalum.

Nickel Directive was introduced and 16% when a follow-up study was performed after the Directive came into force (12). These observations may add to the evidence that the EU Nickel Directive has had an effect on consumer nickel exposure, as positive

DMG test reactions were less prevalent in Denmark and Sweden. It should be underscored that nickel exposure may also come from other sources than earrings, e.g. other jewellery, mobile phones, buttons, zippers, fasteners, and work tools.

The composition of 26 DMG test negative earrings that were randomly selected was examined with XRF spectrometry and showed that nickel was a major constituent in 11% and a minor in 19% (Table 2 and Fig. 1). Two of the gold-plated earrings identified by spectrometry were on a base of Monel alloy, which typically contains as much as 75% nickel. These earrings would be likely to fail the reference method (EN12472:1998) suggested by the European Committee for Standardization (CEN), which simulates 2 years of continuous use, as the gold plating would be eventually worn off. These findings show that the burden of nickel exposure in Thailand and China (and elsewhere) may be even higher if one includes earrings that may release nickel when the coating is worn off following wear and tear. The metal composition found in this study was comparable to that of a previous Italian study (14).

The EN1811 reference method (51) developed to quantify the release of nickel ions after 1 week of exposure to synthetic sweat has been useful in the EU as a framework for the regulation of the manufacturers and distributors of metal products in prolonged contact with the skin. These methods, however, are not practical for consumers, nickel allergic patients, and small businesses when they rapidly and inexpensively want to confirm or exclude excessive nickel release to prevent nickel sensitization and elicitation of dermatitis. Despite the reported shortcomings of false positives and false negative reactions (52–55), the DMG test remains the only commercially available spot test which consumers can use to reliably assess nickel ion release. A Danish study showed that the DMG test became positive when more than 0.5 μg nickel/ cm^2 /week was released from metal alloys and that most nickel allergic patients developed allergic nickel dermatitis when they were patch tested with these alloys (54, 56).

One patch test study has been performed in the general population in Thailand (17). It showed that nickel allergy was very frequent among Thai women as 33.8% were sensitized (17). This finding corresponds well with the significant nickel exposure that we detected in this study. No general population studies have so far been performed in China, but a large-scale patch test investigation is currently being planned and executed. It is likely that the prevalence of nickel allergy is also high in young Chinese women who frequently wear inexpensive jewellery. The literature search showed that the median prevalence of nickel allergy among Chinese and Thai patients with dermatitis was 17.7% and 18.6%, respectively (Tables 3 and 4). The prevalence of nickel allergy was higher in women than men in both China and Thailand,

underscoring the different exposure patterns in men and women. These figures may be slightly higher but generally comparable to those from patch test centres in Europe and the United States (1, 3, 13). A recent Taiwanese patch test study by Cheng et al. showed that prevalence of nickel allergy was highest among patients aged 21–30 years (40.8%) and low among older patients (4.9% among 51–60 year olds and 3.0% among 61–70 year olds) (43). Furthermore, they showed that the overall prevalence of nickel allergy increased between 1978 and 2003 (43). Taken together, these data show that nickel allergy is a current problem in young Chinese and Thai individuals.

In 2002, China emulated the first version of the EU Nickel Directive (9) by enacting the Chinese National Standard (GB 11887). In contrast to the current EU Nickel Directive, this standard limits the content of nickel to a maximum of 0.5% in metal products used in the ear or any other part of the body for piercing, or a product otherwise retained in the body. The EN 1810 reference method is used to confirm that items comply with the Chinese National Standard. As dictated by the EU Nickel Directive, metal products that are in long-term contact with the skin such as jewellery, watches, buttons, and zippers cannot exceed 0.5 μg nickel/ cm^2 /week. The EN1811 (51) has also been adapted by the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China and the Standardization Administration of the People's Republic of China as GB 19719.

With high prevalences of nickel allergy as well as large proportions of earrings that release excessive amounts of nickel in both Thailand and China, there seems to be a public health opportunity to decrease nickel sensitization in the future. It would appear that the Chinese regulation has yet to replicate the decrease in the proportion of nickel ion releasing earrings available for purchase observed in Sweden following the EU Nickel Directive (12) or the decrease in nickel allergy prevalence reported in parts of Europe (3, 8, 11). Efficacy of regulation undoubtedly requires a combination of education and enforcement. The Nickel Institute (www.nickelinstitute.org) representing the nickel producers has historically been supportive of legislative efforts to minimize nickel sensitization caused by nickel releasing products used in contact with the skin. The economic value of nickel used in consumer products in contact with the skin is immaterial to nickel producers, yet it creates a public relations challenge which unnecessarily commutes to all products containing nickel. The Nickel Institute has opened an office in Beijing and their regional representatives supported the Chinese National Standard legislation. A constructive public

health-focused partnership between alloy producers, jewellery manufacturers, distributors and retailers, patch test producers, regulators, dermatologists, and allergists should be encouraged to reduce use of high nickel-containing alloys used in products in contact with the skin and to encourage the diagnosis and prevention of nickel contact dermatitis. Educational efforts will also benefit from awareness catalysed by ongoing publishing of epidemiologic studies reporting on the prevalence of nickel allergy in both the general population and among patient cohorts with clinical histories of eczema or contact dermatitis. An additional global benefit from increased awareness of nickel sensitization in Thailand and China could possibly be the production and export of skin contacting metal products with a greater compliance with the EU and Chinese National Standard Directives. This study underscores that nickel exposure and allergy is a global problem.

Acknowledgements

SmartPractice provided financial support for the purchases.

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Address:
Carsten R. Hamann
Calvin College
3435 Burton SE
Grand Rapids
Michigan 49546
USA
Tel: + 1 602 327 2977
Fax: + 1 602 225 0245
e-mail: hamann511@gmail.com