

Health and safety in nail bars

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Background: Nail bars are a rapidly expanding small business sector. This project addressed Local Authority enforcement officers' concerns about the potential health risks involved with nail treatments and identified areas where further research is needed.

Methods: 71 nail technicians answered a researcher-administered, self-reported occupational health questionnaire. Their data were compared with that from 64 control subjects.

Main Findings

- Nearly all the nail technicians interviewed had received training on nail work that included some aspects of health and safety.
- Compared with the control group, the nail technicians reported a statistically significant, increased prevalence of work-related symptoms, including nasal, neck, shoulder, wrist/hand and lower back problems.
- Compared with the control group, the nail technicians reported elevated levels of work-related lower respiratory symptoms, headaches, upper back and leg and foot problems. These were not statistically significant.
- Very few of the nail technicians interviewed used products containing methyl methacrylate (MMA) and over half were aware of advice or information discouraging the use of acrylic nail products containing MMA. Over a quarter of the nail technicians did not know whether the products they used contained ethyl methacrylate (EMA) or MMA.

Recommendations for further work

- The extent of the health and safety content of nail technicians' training and its application in practice should be investigated.
- The increased prevalence of musculoskeletal disorders (MSDs), reported by the nail technicians in this study, is likely to be caused by working practices and posture. An ergonomic assessment of working practices in this industry is warranted to identify those associated with risk factors for MSDs.
- This study found a higher prevalence of work related nasal and respiratory symptoms in the nail technicians when compared to controls. An investigation of nail technicians' exposure to potentially hazardous dust and vapours is warranted by these findings. Such an investigation should also assess the effectiveness of ventilation systems for reducing exposure.

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EXECUTIVE SUMMARY

Background and aims

Over the last few years nail treatments have increased in popularity in Great Britain. Local authority enforcement officers have raised concerns about the risk of harm to customers and operators, particularly as many owners and operators seem unaware of the potential hazards in this industry. This project aimed to establish the extent of the problem, identify what constitutes good practice and to make recommendations for future work.

Main Findings

Demographics, training and health and safety

In total 588 nail salons were contacted and asked to participate in the study. The response rate was low, with only 6.6% agreeing to participate. All 71 technicians approached (available on the day of visit) agreed to take part in the study and answer a simple occupational health and safety questionnaire. All of the nail technicians interviewed were female.

The controls were office based, being selected from 104 scientific, administrative and non-laboratory female staff at the Health and Safety Laboratory and 64 agreed to take part in the study. The median age for the controls was 38 years, which was significantly higher than the nail technicians (median = 27.0 years).

The smoking status of both populations showed no statistically significant differences.

Nearly all of the nail technicians interviewed received training on nail work and their training included learning about health and safety. Approximately a third of technicians reported having had experience of themselves, a colleague or a customer having problems resulting from products used for nail work. Most of these were attributed to some type of skin problems.

Self reported ill-health symptoms in nail technicians

Nail salon technicians reported a significant increased prevalence of work related nasal symptoms compared to the control group (odds ratio=6.22 [95% CI 1.28-30.29]). A further significant difference was noted between self-reported work related neck, shoulder, wrist/hand problems, and lower back problems with the nail salon technicians reporting a statistically significantly increased prevalence of symptoms compared with the controls in each case. There were elevated levels of work related, self-reported, lower respiratory symptoms (cough and chest tightness), headaches, upper back and leg and feet problems in the nail salon technicians, compared with office based controls. However, these were not statistically significant. Eye irritation was the only condition that was reported by fewer nail technicians than controls. Work related eczema was reported by 7.0% (5/71) of technicians compared to none of the controls but this difference was not statistically significant.

Problems with clients' hands and infection control in the workplace

Most of the technicians interviewed (70%) had encountered clients with nail infections and they generally (77.5%) wouldn't treat clients with nail infections on their natural nails. Over half (57.1%) said that they would also suggest that the client went to their GP. A similar response was found when technicians were asked what they would do if clients had infection around artificial nails. Almost all (87.8%) said that they would remove the artificial nail extension and recommend that the client saw their GP. The most common way of handling clients with dermatitis and warts, was for the technician not to treat the client (26.8%) or to work round the

area (26.8%). A number of technicians (11.3%) reported that they would recommend that the client visited their GP. When dealing with clients with cuts or sores, the most common response (46.5%) was for the technician to avoid the problem area, or cover the area with a sterile dressing or plaster (28.2%). Most of the technicians (85.9%) reported that if the nail treatment caused the clients hands to bleed then they would stop the bleeding, clean the area and cover it with a sterile dressing/plaster. Generally, they would then either sterilise or disinfect the tool they had been using (66.2%).

Methyl methacrylate (MMA) or ethyl methacrylate (EMA) use

Very few technicians (5.6%) used MMA at the salon they were currently employed. Just over half (54.3%) of the technicians surveyed were aware of advice or information about using acrylic nail products that contain MMA. These technicians reported it was a harmful substance and that its use was banned in the USA.

Two fifths (42.3%) of technicians in the survey used acrylic nail products that contained EMA, but over a quarter didn't know whether the products they used contained EMA (26.8%) or MMA (28.2%). All of the technicians who reported using products containing EMA or MMA took steps to prevent themselves from harm. Many of the technicians reported that they used LEV (23.3%), decanted the products into smaller pots (10%) or used gloves and/or masks (13.3%). Two thirds (66.7%) of technicians thought that there were either short term or long term health effects from working with these products.

Product use

Approximately two thirds (62%) of nail technicians used liquid and powder acrylic systems (also known as powder or acrylic) and of these, 27% thought these products were moderately or extremely harmful. Most (84%) of the technicians who used powders and acrylics had read the label and took steps to protect themselves from harm from using these products. These steps included the use of ventilation, masks and gloves.

Approximately two thirds (62%) of nail technicians used UV or gel nails. Of these, 11.4% (5/45) thought the products were moderately harmful. Over three quarters (77.8%) of the technicians who used UV or gel nails had read the label and over half (53.3%) took steps to protect themselves from harm from using these products. These steps included use of ventilation, masks and avoidance of contact.

Two fifths of nail technicians (39.4%) used wrap nail systems and of these, almost a third (28.6%) thought the product was moderately or extremely harmful. Three quarters of the technicians (75%) who used wrap nail systems had read the label and took steps to protect themselves from harm from using these products. Technicians stated that they generally used ventilation to protect themselves from harm.

Over half of nail technicians (60.6%) used nail dehydraters and of these a quarter (25.6%) thought the products were moderately or extremely harmful. Approximately three quarters of the technicians (72.1%) who used these products had read the label and over half (55.8%) took steps to protect themselves from harm from using these products. This was done by avoiding contact with the product to protect them from harm, but also by using ventilation and masks.

Almost all technicians (94.4%) used disinfectant and of these, two fifths (22.8%) thought the products were moderately or extremely harmful. A third of the technicians who used disinfectant (29.9%) had not read the label and just under half (47.8%) did not take steps to protect themselves from harm from using disinfectant products. Those that did, said that they mainly avoided contact with the product and used gloves to protect themselves from harm but over half of technicians 53.1% thought that protective steps were not required or the product was not harmful. Almost all nail technicians used sanitising liquid/gel spray (90.1%) and of

these, almost a quarter (22.8%) thought the products were moderately harmful. Over a third of the technicians who used sanitising liquid/gel spray (34.4%) had not read the label and two thirds (68.8%) did not take steps to protect themselves from harm from using these products. Those technicians that used controls said that they mainly washed off spillages, used gloves and ventilation to protect themselves from harm.

Tool use

Most technicians used non-metal files and buffers, and metal scissors, nail clippers and orange sticks and these were usually reused with more than one client. The most common way of cleaning these tools was with use of sanitising fluid/spray. Operators often referred to this method of decontamination as “sterilisation”, although it is actually a method of sanitisation for hard (non porous) surfaces or skin.

Approximately two thirds of the technicians interviewed used wooden orange sticks and two fifths said they reused them with more than one client. The most common way of cleaning wooden orange sticks (if reused) was by using a sanitising fluid/spray.

Two thirds of the technicians interviewed used brushes for acrylic work and all of them reused them with more than one client. The most common way of cleaning brushes was by using EMA monomer.

Very few of the technicians interviewed (11.8%) used electric files or drills and all of them reused them with more than one client. The most common way of cleaning electric files or drills was by sterilisation using fluid/spray.

Recommendations

Investigate the extent of the health and safety content of nail technician training and determine how it is applied in practice

Almost all of the technicians interviewed had received training from employers or colleges that included health and safety and nearly all of the technicians knew what COSHH regulations and risk assessments were. However, even though the technicians were aware of the regulations, we did not ascertain the extent of their knowledge, how it was put into practice and how much was understood about compliance with COSHH regulations. It would be helpful to make enquiries of colleges about how COSHH is taught on nail technicians training courses, to investigate the health and safety content of nail technicians training and to determine whether college leavers apply their knowledge to their subsequent work activities. Although technicians often reported that they read product labels, over a quarter of technicians reported that they did not know whether or not MMA was an ingredient in the products they used. This suggests that technicians may not fully utilise the information they read on product labels to help them assess the likely risks. To supplement the investigation of COSHH issues it would also be of interest to establish the usefulness of the information provided on product labels in helping nail technicians determine what actions they need to take to reduce exposure to any harmful substances.

Assess ergonomic aspects of working practices in nail salons to enable identification of working practices associated with risk factors for musculoskeletal disorders

Nail salon technicians reported significantly elevated rates of work related self-reported neck, shoulder and wrist/hand and lower back problems compared with the control group and evidence from the literature suggests that there is a significant link between nail technicians' working practice and posture and the elevated rates of MSDs. Elevated levels of work related headaches, upper back and leg and feet problems were also found in the nail salon technicians, compared with the controls. However, these were not found to be statistically significant. The lack of statistical significance in these findings could be attributed to the low recruitment attained which may have lead to type 2 errors, as the final numbers recruited were half that expected. The work performed by nail salon technicians includes a combination of the documented risk factors for musculoskeletal injury. An ergonomic assessment of work practices in this industry would enable identification of the working practices associated with musculoskeletal disorders. Once the causes had been identified then further work could be considered, such as guidance and interventions that could be put in place to minimise the impact of each of musculoskeletal risk factors and reduce the occurrence of this type of injury within the profession.

Establish levels of worker exposure to airborne particles in nail salons and effectiveness of ventilation systems for reducing exposure

This study found elevated risks for work related nasal and respiratory symptoms in nail technicians when compared to matched controls. This was only statistically significant for nasal symptoms. The extent of the conclusions that can be drawn from these findings is somewhat limited by the low participation rates, also it is likely that only the best salons, who considered themselves to be without health problems, agreed to participate. Low recruitment may also have lead to type 2 errors as the final numbers recruited were half that expected. The aetiology of such symptoms is not clear from this study as the risks relating to current use of EMA/MMA and exposure to airborne dust were not determined. An investigation of worker exposure to dust and vapours in a number of nail salons and the type of ventilation used to reduce exposure is warranted by these findings. This activity would need to undertaken alongside an ergonomic assessment of the postures assumed by technicians, to establish whether the types of ventilation used did not contribute to the musculoskeletal disorders reported by technicians.

Establish why the working age of nail technicians was lower than that of controls

The controls had a higher median age (38 years) compared to the nail technicians (27 years). This difference in age may be due to chance or to nail work being a young and new emerging industry. However, another explanation for the differences could be if nail technicians tend to leave the industry at an early stage for some reason, such as perhaps to pursue a different career or due to ill-health reasons. Further investigation would be needed to clarify this point.

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1 INTRODUCTION

Artificial nail extensions have been available since the 1950s but became popular in the early 1970s when methyl methacrylate acrylic resin, used as a fixative in dentistry, was introduced into the artificial nail process. In the last few years, nail treatment salons (often referred to as 'nail bars') have become a rapidly expanding small business sector. Methyl Methacrylate monomer (MMA) is a known irritant to the skin, eyes and respiratory tract and can cause skin and respiratory allergy (Cosmetic Ingredient Review Expert Panel, 2002). The U.S Food and Drug Administration (FDA, 2000) regards MMA as a poisonous and deleterious substance and since May 1999 its use has been banned in around 23 U.S states (Beauty for Nails, 2006). Nail products containing MMA are not banned in Britain, although good working practice has resulted in it being largely replaced by ethyl methacrylate (EMA), which is thought to be a less potent sensitiser and is therefore thought to be safe if used according to manufacturers directions (Cosmetic Ingredient Review Expert Panel, 2002). However, under the Chemicals (Hazardous Information and Packaging for Supply) Regulations (HSE, 2002) EMA is classified as irritating to eyes, respiratory system and skin, and has the potential to cause sensitisation. It is also likely that products containing MMA (particularly imported products), are still in use in some salons as this ingredient is reported to be approximately seven times cheaper than EMA (Beauty for Nails, 2006) and although a Workplace Exposure Limit (WEL) for MMA is in place, there are no available data regarding exposure levels in British nail salons.

There are limited published studies investigating ill-health in nail salon technicians, but the available data have cited individuals suffering from occupational asthma and allergic contact dermatitis who are either nail technicians or artificial nail-wearers (Fitzgerald and English, 1994; Spencer *et al.*, 1997; Cosmetic Ingredient Review Expert panel, 2002; Hemmer *et al.*, 1996, Kanerva *et al.*, 1996; Freeman *et al.*, 1995). A further study demonstrated that, compared with controls, nail workers have a higher incidence of throat and skin irritation, drowsiness, dizzy spells and trembling of the hands (Hiipakka and Samimi, 1987). However, this study is now 20 years old and only found statistically significant differences in throat irritation between the nail salon technicians and control group.

There are data reporting the incidence of respiratory and skin symptoms in beauticians, although it is not known how many of these are nail technicians. The Surveillance of Work Related and Occupational Respiratory Disease (SWORD) reporting scheme (web page: <http://www.medicine.manchester.ac.uk/coeh/thor/schemes/sword/>) reported 29 estimated (7 actual) cases of asthma between 1989 and 2005 and the 'EPIDERM' dermatological reporting scheme <http://www.medicine.manchester.ac.uk/coeh/thor/schemes/epiderm/> ranked beauticians and related occupations (excluding hairdressing) as 3rd highest at-risk group for contact dermatitis, with acrylates being among the most frequently reported agents (personal communication).

Electronic filing tools, clipping tools and other tools are used in nail salons and these may be inappropriately cleaned/sterilised in some salons. This practice can potentially increase the risk of exposure to dusts and pathogenic micro-organisms. Recently, two cases of acute hepatitis B were investigated by the Dutch Municipal Health Service and the most probable source was a nail studio (Worp *et al.*, 2006).

Aside from the chemical and microbiological risk, nail technicians may also experience musculo-skeletal disorders (MSDs) by maintaining awkward postures of the upper body and limbs while performing highly repetitive tasks (Riddell, 2000), but again, little information is available to suggest the extent of this problem within this industry.

A survey of occupational hygienists by the U.S. National Institute of Occupational Safety and Health (NIOSH; 1999) reported that nail salons were considered to be in great need of an evaluation of perceived safety and health risks. There was a need also for guidance materials on

hazards and controls for owners and workers. As British nail salons have similar hazards, staff awareness levels and guidance availability, it is reasonable to assume that they would have similar needs. As nail treatments have increased in popularity in Great Britain, local authority enforcement officers have raised concerns about the risk of harm to customers and operators, particularly as many owners and operators seem unaware of the potential hazards in this industry. An evaluation exercise was therefore required to establish the extent of the problem and identify what constitutes good practice. These results could then be used to inform guidance.

2 METHODS

2.1 RECRUITMENT

Nail salons were recruited from a mixture of rural and urban areas in the North, South and Midlands regions of England. A database of salons was collated for each study location using online business directories (www.yell.co.uk and www.thomsonlocal.co.uk), which was supplemented by lists supplied by local environmental health practitioners. All salon managers were sent a letter of invitation, including information sheet and consent form, which was followed up with phone calls from a member of the study team. The study was also publicised with an editorial article in the industry magazine 'Scratch' (Ward, 2006). The controls were recruited via a call for volunteers notice which was circulated by email to all staff at HSL. The invitation to participate excluded male workers, as all of the nail technicians were female. It also excluded workers who worked in scientific testing laboratories, as they were more likely to come into contact with skin and respiratory irritants and sensitisers through the course of their work, compared with the control group of staff.

2.2 HEALTH AND SAFETY QUESTIONNAIRE

A simple interviewer-led health and safety questionnaire was administered to all consenting nail salon technicians participating in the study. The questionnaire evaluated the extent of individuals' health and safety knowledge relating to their occupation. Questions were also asked about their training and qualifications, and their assessment and perception of risk regarding the products, tools/equipment used for nail services. The questionnaire enquired about skin, respiratory and musculoskeletal problems and was based on an adaptation of the Medical Research Council (Minette, 1989), European Community Respiratory Health Survey (Burney, 1994) and Nordic designs (Kuorinka, 1987) respectively. The questionnaire focused on the presence (or absence) of a work relationship for each particular symptom and recorded the full work history. Work related symptoms were defined as those described by the individual as worse at work or improving on rest days (during the weekend or on holiday). The same work related health questions were asked of the control population.

2.3 STATISTICAL ANALYSIS

All data analyses were performed using SPSS software (Statistical Package for Social Scientists v13.0, SPSS Inc., Chicago, USA). Descriptive statistical analyses were first performed on the data to establish demographic characteristics of the populations and responses to questions concerning health and safety issues. When technicians were asked open ended questions, they often had more than one response, which is included in the analysis. In some situations, the technician did not provide a response to the question and the statistical analysis is adjusted to reflect this. Logistic regression models were then used to estimate the independent effects of occupation on a range of outcome variables, including the reporting of work related respiratory symptoms, musculoskeletal problems and eczema. Odds ratios were adjusted for the potential confounding effects of age, smoking status and time spent working in industry.

3 RESULTS

3.1 DEMOGRAPHICS AND PARTICIPATION RATES

In total 588 nail salons were contacted and asked to participate in the study. Only 4 salons returned a consent form in response to the initial contact and the remainder were followed up by telephone. The response rate was low, with only 6.6% (39 nail salons in total) agreeing to participate. The most common reason that non-participants gave to our researchers was time constraints. The researchers noted other reasons included having recently been inspected by the local authority. The nail salons visited were micro-businesses (each employing less than nine staff) so each nail technician was asked to participate. Of the 71 nail technicians approached (those available on the day of visit), 71 agreed to take part in the study and answer a simple occupational health and safety questionnaire. All of the nail technicians interviewed were female. The controls were selected from 104 administrative non-laboratory scientific female staff at the Health and Safety Laboratory and 64 (61.5%) agreed to take part in the study. The median age for the controls was 38 years, which was significantly higher ($p \leq 0.001$) than the nail technicians (median = 27.0 years). In some situations, the technician did not provide a response to the question and the statistical analysis is adjusted to reflect this.

Table 1: Worker Characteristics

Characteristics	Nail salon technicians n=71	Office based controls n=64
Age (years)		
Mean (SD)	30.0 (9.7)	38.0 (9.8)
Median	27.0	38.0
Range	18-59	20-59
Total years in industry		
Mean (SD)	6.37 (4.68)	12.4 (10.01)
Median	5.0	9.5
Range	0.5-25	1-34
Number of staff:		
In full time employment (%)	51 (71.8)	52 (82.5)
In part time employment (%)	20 (28.2)	11 (17.5)
Smoking		
Current (%)	10 (14.1)	9 (14.3)
Ex (%)	15 (21.1)	13 (20.6)
Never (%)	46 (64.8)	41 (65.1)

MAIN POINTS (1)
DEMOGRAPHICS AND PARTICIPATION RATES

Of 588 nail salons who were asked to participate in the study only 6.6% agreed to participate.

71 nail technicians were approached and agreed to take part in the study and answer a simple occupational health and safety questionnaire.

All of the nail technicians interviewed were female.

64/104 (61.5%) controls at the Health and Safety Laboratory agreed to take part in the study.

The median age for the controls was 38 years, which was significantly higher ($p \leq 0.001$) than the nail technicians (median = 27.0 years).

The smoking status of both populations showed no statistically significant differences.

3.2 NAIL TECHNICIANS TRAINING AND HEALTH AND SAFETY

98.6% (70/71) of nail technicians had received training on nail work, with 87.3% (62/71) receiving aspects of training from college, followed by 56.3% (40/71) from their present or previous employer, 40.8% (29/71) from suppliers, 32.4% (23/71) from fellow workers, 31% (22/71) from product instruction, 21.1% (15/71) from textbooks, 9.9% (7/71) from magazines, 7% (5/71) from a product sampler and 2.8% (2/71) from a home instruction course.

40.8 % (29/71) held a beauty NVQ (National Vocational Training) level 3 as their highest level of nail technician qualification, 11.3% (8/71) held a NVQ level 2 qualification in Beauty and 11.3% (8/71) also held a NVQ level 3 in nail services. Other training qualifications attained included nail suppliers training (19.7%, [14/71]) a manicure certificate (12.7%, [9/71]), nail services NVQ level 2 (4.2%, [3/71]), level 2 VTCT (Vocational Training Charitable Trust) (9.9%, [7/71]) and a diploma in advanced nail techniques (4.2%, [3/71]). All of the nail technicians interviewed in this study reported that their training included learning about health and safety.

**MAIN POINTS (2)
TRAINING**

Almost all (98.6%; 70/71) of nail technicians reported that they received training on nail work. 87.3% (62/71) received training in nail work from college, followed by 56.3% (40/71) from their present or previous employer, 40.8% (29/71) from suppliers.

40.8 % (29/71) held a NVQ level 3 in Beauty as their highest level of nail technician qualification, followed by (19.7%, 14/71) who had received nail suppliers' training and (12.7%, 9/71) a manicure certificate.

All of the nail technicians interviewed in this study reported that their training included learning about health and safety.

When the nail technicians were asked to consider the products that they used in nail work, 90.1% (64/71) thought that their knowledge of these products was either very good or quite good. Just over half of the technicians interviewed (56.3% [40/71]) thought that their health was either 'at risk' or 'possibly at risk' from using these chemicals. 12.8% (5/39) thought that this risk was 'high' and two thirds (59% [23/39]) felt the risk was 'medium'. Most of the technicians interviewed (81.7% [58/71]) did not think their client's health was at risk from the products used.

Table 2: Technicians perceived Health and Safety risk about products used in nail salons

KNOWLEDGE OF HEALTH AND SAFETY OF PRODUCTS USED	23/71 (32.4%) Very Good	41/71 (57.7%) Quite Good	7/71 (9.9%) Neither good or poor	
DO YOU FEEL YOUR HEALTH MIGHT BE AT RISK FROM THE PRODUCTS YOU WORK WITH?	17/71 (23.9%) Yes	23/71 (32.4%) Possibly	28/71 (39.34%) No	3/71 (4.2%) Not sure
IF YOU FEEL YOUR HEALTH IS (OR IS POSSIBLY) AT RISK, WHAT LEVEL IS THE RISK	5/39 (12.8%) High	23/39 (60%) Medium	11/39 (28.2%) Low	
DO YOU FEEL YOUR CLIENTS HEALTH IS AT RISK FROM THE PRODUCTS YOU WORK WITH?	13/71 (18.3%) Yes	58/71 (81.7%) No		
IF YOU FEEL YOUR CLIENTS HEALTH IS AT RISK, WHAT LEVEL IS THE RISK	1/13 (7.7%) High	7/13 (53.8%) Medium	5/13 (38.5%) Low	

A third of technicians (31.0% [22/71]) had experience of themselves, a colleague or a customer having problems resulting from products used for nail work; these experiences included dermatitis, breathing difficulties, allergic reaction, burns, nasal problems or nail infections (table 3).

Table 3: Technicians experience of problems resulting from products used for nail work and their knowledge of regulations that apply to the chemicals and products they use in their work place

	Yes	No	IF YES WHAT WAS IT?
HAVE YOU HAD EXPERIENCE OF YOURSELF, A COLLEAGUE OR CUSTOMER HAVING PROBLEMS RESULTING FROM PRODUCTS USED FOR NAIL WORK?	22/71 (31.0%)	49/71 (69.0%)	Dermatitis 4/22 (18.2%) Breathing difficulties 5/22 (22.7%) Allergic reaction 10/22 (45.5%) Burns, nasal problems or nail infections each reported by 1/22 (4.5%)*.
DO YOU KNOW THE NAMES OF ANY REGULATIONS THAT APPLY TO THE USE OF CHEMICALS OR PRODUCTS IN YOUR WORKPLACE?	48/71 (67.6%)	23/71 (32.4%)	COSHH 37/48 (77%) COSHH and RIDDOR 5/48 (10.4%) non-regulation answer 6/48 (12.5%)
* We have assumed that the allergic reactions reported would be a skin reaction (Adishes, personal communication). Therefore, 14/22 (63.6%) of technicians who had experienced colleagues, customers or themselves having problems resulting from nail work, reported a skin problem.			

When un-prompted by the survey question, over two thirds of the technicians (67.6%, [48/71]) reported that they knew the names of some of the regulations that applied to the use of chemicals or products in their workplace. 37/48 (77.1%) mentioned the Control of Substance Hazardous to Health (COSHH) Regulations, and 5/48 (10.4%) mentioned COSHH and the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR), 1995. When asked if they had heard of COSHH, most technicians (59/70, 84.3%) said that they knew what COSHH was. Nearly all (65/70, 92.9%) of the nail technicians reported that they knew what a risk assessment was, however only 38.0% (27/71) knew what a 'material safety data sheet' was.

**MAIN POINTS (3)
HEALTH AND SAFETY**

Over half of the technicians interviewed (56.3% [40/71]) thought that their health was either 'at risk' or 'possibly at risk' from using these chemicals, however only 12.8% (5/39) thought that this risk was 'high'.

Most of the technicians interviewed (81.7% [58/71]) thought that their client's health was not at risk from the products used.

A third of technicians (31.0% [22/71]) had experience of themselves, a colleague or a customer having problems resulting from products used for nail work. However, most of these were attributed to skin problems.

Nearly all (65/70, 92.9%) of the nail technicians interviewed reported that they knew what a risk assessment was. Most (59/70, 84.3%) of the technicians interviewed reported that they knew what COSHH was and only 38.0% (27/71) knew what a 'material safety data sheet' was.

3.3 PRODUCTS USED IN NAIL SALONS

A brief overview of the main products used in nail extension work can be found in Appendix 1.

3.3.1 Liquid and powder systems

62% (44/71) of nail technicians used liquid and powder acrylic systems (also known as powder or acrylic) and of these, 27% (12/44) thought these products were moderately or extremely harmful. Most of the technicians who used liquid and powder systems had read the label (84.1% [37/44]) and took steps to protect themselves from harm from using these products (81.8% [36/44]). Those technicians who took protective steps generally used ventilation, followed by masks and gloves for this purpose (table 4).

Table 4: Technician usage of liquid and powder acrylic systems

POWDERS AND/OR ACRYLICS	RESPONSE
How often do you use this product?	25/44 (56.8%) Everyday 16/44 (36.4%) Every week 0/44 (0%) Every month 3/44 (6.8%) Less often
How harmful do you think this product is?	10/44 (22.7%) Not at all 11/44 (25.0%) Moderately 22/44 (50.0%) Slightly 1/44 (2.3%) Extremely
Have you ever read the label	37/44 (84.1%) Yes 6/44 (13.6%) No 1/44 (2.3%) Did not answer
Do you take any steps to protect yourself from harm from using this product?	36/44 (81.8%) Yes 8/44 (18.2%) No
If yes, can you tell me what they are?	Ventilation 18/44 (40.9%) Gloves 4/44 (9%) Masks 4/44 (9%) Put lids on chemicals 3/44 (6.8%) Do not inhale 2/44 (4.5%) Good hygiene 2/44 (4.5%) Decant products into smaller pots 1/44 (2.3%) No skin contact 1/44 (2.3%) Use as instructed 1/44 (2.3%)
If not, is there a reason why?	Not needed 2/8 (25%) Mask gets in the way 2/8 (25%) Products safe 2/8 (25%) Never come to harm before 1/8 (12.5%) Nothing to protect ourselves with 1/8 (12.5%)

3.3.2 UV or gel nails

63.4% (45/71) of nail technicians used UV or gel nails and of these, 11.4% (5/45) thought the products were moderately harmful. Most of the technicians who used UV or gel nails had read the label (77.8% [35/45]) and half said that they took steps to protect themselves from harm from using these products (53.3% [24/45]). Those technicians who took protective steps mainly used ventilation, masks and avoidance of contact for this purpose. 8.89% (4/45) of technicians mentioned that they would ensure that the lids were kept on products.

Table 5: Technician usage of UV or gel nails

UV OR GEL NAILS	RESPONSE
How often do you use this product?	17/45 (37.8%) Everyday 13/45 (28.9%) Every week 6/45 (13.3%) Every month 9/45 (20.0%) Less often
How harmful do you think this product is?	23/45 (52.3%) Not at all 16/45 (36.4%) Slightly 5/45 (11.4%) Moderately 0/45 (0%) Extremely
Have you ever read the label	35/45 (77.8%) Yes 10/45 (22.2%) No
Do you take any steps to protect yourself from harm from using this product?	24 (53.3%) Yes 21 (46.7%) No
If yes, can you tell me what they are?	Ventilation 5/45 (11.1%) Keep lids on products 4/45 (8.89%) Avoid skin contact 4/45 (8.89%) Masks 4/45 (6.67%) Good hygiene 3/45 (6.67%) Gloves 1/45 (2.2%) Use goggles 1/45 (2.2%) Don't look at it 1/45 (2.2%) Use as instructed 1/45 (2.2%)
If not, is there a reason why?	Consider low risk/not required 2/21 (9.5%) Difficulty using gloves 1/21 (4.8%) Have never come to harm before 1/21 (4.8%) Nothing to protect ourselves with 1/21 (4.8%) No fumes with this product 1/21 (4.8%)

3.3.3 Wrap nail systems

28/71 (39.4%) of nail technicians used wrap nail systems and of these, almost a third thought the product was moderately or extremely harmful (28.6% [8/28]). Three quarters of the technicians who used wrap nail systems had read the label (75.0% [21/28]) and took steps to protect themselves from harm from using these products (75.0% [21/28]). Technicians stated that they generally used ventilation to protect themselves from harm.

Table 6: Technician usage of Wrap nail systems

WRAP NAIL SYSTEMS	RESPONSE
How often do you use this product?	8/28 (28.6%) Everyday 7/28 (25.0%) Every week 6/28 (21.4%) Every month 7/28 (25.0%) Less often
How harmful do you think this product is?	5/28 (17.9%) Not at all 15/28 (53.6%) Slightly 4/28 (14.3%) Moderately 4/28 (14.3%) Extremely
Have you ever read the label	21/28 (75.0%) Yes 7/28 (25.0%) No
Do you take any steps to protect yourself from harm from using this product?	21/28 (75.0%) Yes 7/28 (25.0%) No
If yes, can you tell me what they are?	Ventilation 10/21 (47.6%) Gloves 2/21 (9.5%) Avoid skin contact 2/21 (9.5%) Spray at a distance 2/21 (9.5%) Keep lids on products 1/21 (4.8%) Good hygiene 1/21 (4.8%)
If not, is there a reason why?	Not needed 3/7 (42.9%) Mask uncomfortable/off-putting 2/7 (28.6%) Nothing to protect ourselves with 1/7 (14.3%) Use common sense 1/7 (14.3%)

3.3.4 Nail dehydraters

Over half (60.6% [43/71]) of nail technicians used nail dehydraters and of these a quarter (25.6% [11/43]) thought the products were moderately or extremely harmful. Nearly three quarters of the technicians who used nail dehydraters had read the label (72.1% [31/43]) and over half said that they took steps to protect themselves from harm from using these products (55.8% [24/43]). Technicians mainly said that they avoided contact with the product to protect them from harm, but some also reported using ventilation and masks. 10/18 (55.6%) of those that didn't use protection thought that protective steps were not required.

Table 6: Technician usage of nail dehydraters

NAIL DEHYDRATERS	RESPONSE
How often do you use this product?	22/43 (51.2%) Everyday 13/43 (30.2%) Every week 3/43 (7.0%) Every month 5/43 (11.6%) Less often
How harmful do you think this product is?	12/43 (27.9%) Not at all 20/43 (46.5%) Slightly 9/43 (20.9%) Moderately 2/43 (4.7%) Extremely
Have you ever read the label	31/43 (72.1%) Yes 12/43 (27.9%) No
Do you take any steps to protect yourself from harm from using this product?	24/43 (55.8%) Yes 18/43 (41.9%) No 1/43 (2.3%) No response
If yes, can you tell me what they are?	Avoid skin contact 7/25 (28%) Masks 4/25 (16%) Ventilation 4/25 (16%) Gloves 3/25 (12%) Keep lids on products 3/25 (12%) Good hygiene 2/25 (8%) Use sparingly 1/25 (4%) Use as instructed 1/25 (4%)
If not, is there a reason why?	Not needed 10/18 (55.6%) No reason 4/18 (22.2%) Not used often enough 1/18 (5.6%) Have never come to harm before 1/18 (5.6%) Nothing to protect ourselves with 1/18 (5.6%)

3.3.5 Disinfectant

Almost all (67/71 [94.4%]) of nail technicians used disinfectant and of these, one fifth (22.8% [15/66]) thought the products were moderately or extremely harmful. A third of the technicians (29.9% [20/67]) who used disinfectant had not read the label and just under half did not take steps to protect themselves from harm from using these products (47.8% [32/67]). Technicians said that they mainly avoided contact with the product and used gloves to protect them from harm. Over half of technicians (17/53 [53.1%]) thought that protective steps were not required or the product was not harmful.

Table 7: Technician usage of disinfectant

DISINFECTANT	RESPONSE
How often do you use this product?	52/67 (77.6%) Everyday 14/67 (20.9%) Every week 1/67 (1.5%) Every month 0/67 (0%) Less often
How harmful do you think this product is?	29/66 (43.9%) Not at all 22/66 (33.3%) Slightly 11/66 (16.7%) Moderately 4/66 (6.1%) Extremely
Have you ever read the label	47/67 (70.1%) Yes 20/67 (29.9%) No
Do you take any steps to protect yourself from harm from using this product?	35/67 (52.2%) Yes 32/67 (47.8%) No
If yes, can you tell me what they are?	Gloves 10/35 (28.6%) Avoid skin contact 8/35 (22.9%) Follow instructions on labelling 5/35 (14.3%) Good hygiene 4/35 (11.4%) Mask 3/35 (8.6%) Ventilation 3/35 (8.6%) Don't inhale 1/35 (2.9%) Keep in a safe place 1/35 (2.9%)
If not, is there a reason why?	Not needed/not harmful 17/32 (53.13%) No skin contact involved 2/32 (6.3%) Not thought about it 2/32 (6.3%) Have never come to harm before 1/32 (3.1%) Nothing to protect ourselves with 1/32 (3.1%) Use common sense 1/32 (3.1%)

3.3.6 Alcohol-based sanitising liquid/gel spray

Almost all (90.1% [64/71]) of nail technicians used sanitising liquid/gel spray and of these, almost a quarter (22.8% [15/66]) thought the products were moderately harmful. Over a third of the technicians who used sanitising liquid/gel spray had not read the label (34.4% [22/64]) and two thirds did not take steps to protect themselves from harm from using these products (68.8% [44/64]). Those technicians that used controls said that they mainly washed off spillages, used gloves and ventilation to protect themselves from harm. Over half of the technicians that did not use protective measures thought that they were not required (56.8% [25/44]).

Compared with the other products the survey asked about, a larger proportion (over a third of technicians) had not read the labels of disinfection and sanitising products.

Table 8: Technician usage of sanitising liquid/gel spray

SANITISING LIQUID/GEL SPRAY	RESPONSE
How often do you use this product?	53/64 (82.8%) Everyday 8/64 (12.5%) Every week 2/64 (3.1%) Every month 0/64 (0%) Less often 1/64 (1.6%) no response
How harmful do you think this product is?	43/63 (68.3%) Not at all 15/63 (23.8%) Slightly 5/63 (7.9%) Moderately 0/63 (0%) Extremely
Have you ever read the label	42/64 (65.6%) Yes 22/64 (34.4%) No
Do you take any steps to protect yourself from harm from using this product?	20/64 (31.3%) Yes 44/64 (68.8%) No
If yes, can you tell me what they are?	Ventilation 5/21 (23.8%) Gloves 4/21 (19.1%) Wash off spills 4/21 (19%) Follow instruction on labelling 3/21 (14.3%) Masks 1/21 (4.8%) Avoid eye contact 1/21 (4.8%) Good hygiene 1/21 (4.8%) Good practice 1/21 (4.8%)
If not, is there a reason why?	Not needed 25/43 (58.1%) Don't think about it 2/43 (4.7%) No skin contact 1/43 (2.3%) Have never come to harm before 1/43 (2.3%) Use common sense 1/43 (2.3%)

MAIN POINTS (4)
PRODUCT USE

62% of nail technicians used liquid and powder acrylic systems (also known as powder or acrylic) and of these, 27% thought these products were moderately or extremely harmful. Most of the technicians who used powders and acrylics had read the label and took steps to protect themselves from harm from using these products. These steps included the use of ventilation, masks and gloves

63.4% of nail technicians used UV or gel nails. Of these, 11.4% (5/45) thought the products were moderately harmful. Over three quarters of the technicians who used UV or gel nails had read the label and over half took steps to protect themselves from harm from using these products. These steps included use of ventilation, masks and avoidance of contact. Almost a quarter of technicians thought the risk to harm from using UV or gel nails was low and that protective steps were not required.

Two fifths of nail technicians used wrap nail systems and of these, almost a third thought the product was moderately or extremely harmful. A quarter of the technicians who used wrap nail systems had not read the label and the same proportion did not take steps to protect themselves from harm from using these products. Those that did stated that they generally used ventilation to protect themselves from harm.

Over half of nail technicians used nail dehydraters and of these a quarter thought the products were moderately or extremely harmful. Approximately three quarters of the technicians who used nail dehydraters had read the label and over half took steps to protect themselves from harm from using these products. This was done by avoiding contact with the product to protect them from harm, but also by using ventilation and masks.

Compared with the other products the survey asked about, a larger proportion (over a third) had not read the labels of disinfection and sanitising products. Over two thirds of technicians used disinfectants and of these, two fifths thought the product was moderately or extremely harmful. A third of the technicians who used disinfectant had not read the label and just under half did not take steps to protect themselves from harm from using these products. Technicians said that they mainly avoided contact with the product and used gloves to protect them from harm. Almost all nail technicians used sanitising liquid/gel spray and of these, almost a quarter thought the products were moderately harmful. Over a third of the technicians who used sanitising liquid/gel spray had not read the label and a two thirds did not take steps to protect themselves from harm from using these products. Those technicians that used controls said that they mainly washed off spillages, used gloves and ventilation to protect themselves from harm. Over half of the technicians that did not use protective measures thought that they were not required.

3.4 USE OF ACRYLIC PRODUCTS CONTAINING METHYL METHACRYLATE (MMA) OR ETHYL METHACRYLATE (EMA)

Of the nail technicians interviewed, very few reported that they currently used MMA for nail services (4/71 [5.6%]) and over half (38/70 [54.3%]) were aware of advice or information advising against using acrylic nail products that contain MMA. These technicians reported it was known to be a harmful substance (19/38), it was thought to be banned in the USA (12/38) and that it caused skin allergies and irritation (2/38).

42.3% (30/71) of the technicians in the survey reported using acrylic nail products that contained EMA, but a further 26.8% (19/71) didn't know whether they used EMA and 28.2% (20/71) didn't know whether they used MMA.

All technicians who reported using products containing EMA or MMA also said that they took measures to control exposure. These included the use of LEV (23.3% [7 /30]), decanting the products into smaller pots (10% [3/30]), using gloves (6.7% [2/30]), masks (6.7% [2/30]) or both gloves and masks (13.3% [4/30]), using natural ventilation (3.3% [1/30]), and avoidance of skin contact (3.3% [1/30]). Two thirds (66.7% [38/57]) of technicians thought that there were either short term or long term health effects from working with these products. 22.8% [13/57] did not know, and 2/57 did not respond.

MAIN POINTS (5) EMA AND MMA USE

Very few technicians (5.6%) used MMA in their salon.

Over half (54.3%) of the technicians surveyed were aware of advice or information about using acrylic products that contain MMA. These technicians reported it was a harmful substance and thought that its use was banned in the USA.

42.3% (30/71) of technicians in the survey used acrylic nail products that contained EMA, but over a quarter didn't know whether the products they used contained EMA (26.8%) or MMA (28.2%).

All technicians who reported using products containing EMA or MMA also said they took steps to protect themselves from harm. Many of the technicians reported that they used LEV, decanted the products into smaller pots or used gloves and/or masks.

Two thirds (66.7%) of technicians thought that there were either short term or long term health effects from working with these products.

3.5 TOOL USE IN NAIL SALONS

3.5.1 Files or buffers

Almost all technicians (92.8% [64/69]) used both files and buffers and generally they were reused with more than one client. The most common way of cleaning these tools was with use of sanitising fluid/spray (80% [52/65]). Operators often referred to this method of decontamination as "sterilisation", although it is actually a method of sanitisation for hard (non porous) surfaces or skin.

Table 9: Technician usage of files or buffers

FILES OR BUFFERS	RESPONSE
Do you use files or buffers	Files 5/69 (7.2%) Files and buffers 64/69 (92.8%)
How are these products used?	Files reused with more than one client 5/5 (100%) Files and buffers reused with more than one client 60/64 (93.8%) Files and buffers disposed of after single use 4/64 (6.3%)
For tools that are reused, how are they cleaned between uses?	Files “sterilised” using fluid spray 4/5 (80.0 %) Files cleaned and disinfected 1/5 (20.0%) Files and buffers ‘sterilised’ using fluid/spray 48/60 (80%) Files and buffers not cleaned 3/60 (5.0%) Files and buffers dry wiped clean 3/60 (5.0%) Files and buffers cleaned and disinfected 3/60 (5.0%) Files and buffers disinfected without cleaning 2/60 (3.3%) Files and buffers sterilised (using autoclave) 1/60 (1.7%)

3.5.2 **Metal orange sticks**

Approximately half of the technicians interviewed (34/69 [49.3%]) used metal orange sticks and all of them said they reused them with more than one client. The most common way of cleaning metal orange stick (if reused) was by “sterilisation” using fluid/spray (19/34 [55.9%]).

Table 10: Technician usage of metal orange sticks

METAL ORANGE STICKS	RESPONSE
Do you use metal orange sticks	Yes 34/69 (49.3%) No 35/69 (50.7%)
How are these products used?	Reused with more than one client 34/34 (100%)
For tools that are reused, how are they cleaned between uses?	“Sterilised” using fluid/spray 19/34 (55.9%) Cleaned and disinfected 11/34 (32.4%) Disinfected without cleaning 3/34 (8.8%) Sterilised (using autoclave) 1/34 (2.9%)

3.5.3 **Wooden orange sticks**

Over two thirds of the technicians interviewed (47/69 [68.1%]) used wooden orange sticks and 40.4% (19/47) said they reused them with more than one client. The most common way of cleaning wooden orange sticks (if reused) was by “sterilisation” using fluid/spray (12/18 [66.7%]).

Table 11: Technician usage of wooden orange sticks

WOODEN ORANGE STICKS	RESPONSE
Do you use wooden orange sticks	Yes 47/69 (68.1%) No 22/69 (31.9%)
How are these products used?	Disposed of after single use 28/47 (59.6%) Reused with more than one client 19/47 (40.4%)
For tools that are reused, how are they cleaned between uses?	“Sterilised” using fluid/spray 12/18 (66.7%) Not cleaned 2/18 (11.1%) Sterilised (using autoclave) 1/18 (11.1%) Dry wiped clean 1/18 (5.6%) Cleaned and disinfected 1/18 (5.6%)

3.5.4 Scissors

Most of the technicians interviewed (53/69 [76.8%]) used scissors and all of them reused them with more than one client. The most common way of cleaning scissors was by “sterilisation” using fluid/spray (32/53 [60.4%]).

Table 12: Technician usage of scissors

SCISSORS	RESPONSE
Do you use scissors	Yes 53/69 (76.8%) No 19/69 (23.2%)
How are these products used?	Reused with more than one client 53/53 (100%)
For tools that are reused, how are they cleaned between uses?	“Sterilised” using fluid/spray 32/53 (60.4%) Cleaned and disinfected 11/53 (20.8%) Disinfected without cleaning 3/53 (5.7%) Dry wiped clean 2/53 (3.8%) Cleaned using detergent 2/53 (3.8%) Sterilised (using autoclave) 2/53 (3.8%) Not cleaned 1/53 (1.9%)

3.5.5 Brushes for acrylic work

Many of the technicians interviewed (46/69 [66.7%]) used brushes for acrylic work and all of them reused them with more than one client. The most common way of cleaning brushes was by using EMA monomer (21/46 [45.7%]).

Table 13: Technician usage of brushes for acrylic work

BRUSHES FOR ACRYLIC WORK	RESPONSE
Do you use brushes	Yes 46/69 (66.7%) No 23/69 (33.3%)
How are these products used?	Reused with more than one client 46/46 (100%)
For tools that are reused, how are they cleaned between uses?	Using acrylic/EMA 21/46 (45.7%) "Sterilised" using fluid/spray 15/46 (32.6%) Dry wiped clean 3/46 (6.5%) Cleaned using detergent 3/46 (6.5%) Cleaned and disinfected 2/46 (4.3%) Sterilised (using autoclave)1/46 (2.2%) Not cleaned 1/46 (2.2%)

3.5.6 Electric files (also known as "drills")

Very few of the technicians interviewed (8/68 [11.8%]) used electric files or drills and all of them reused them with more than one client. The most common way of cleaning electric files or drills was by "sterilisation" using fluid/spray (4/8 [50.0%])

Table 14: Technician usage of electric files or drills

ELECTRIC FILES OR DRILLS	RESPONSE
Do you use electric files or drills	Yes 8/68 (11.8%) No 60/68 (88.2%)
How are these products used?	Reused with more than one client 46/46 (100%)
For tools that are reused, how are they cleaned between uses?	"Sterilised" using fluid/spray 4/8 (50.0%) Not cleaned 1/8 (12.5%) Cleaned using detergent 1/8 (12.5%) Cleaned and disinfected 1/8 (12.5%) Sterilised (using autoclave)1/8 (12.5%)

3.5.7 Nail clippers

Most of the of the technicians interviewed (64/69 [92.8%]) used nail clippers and all of them reused them with more than one client. The most common way of cleaning nail clippers was by "sterilisation" using fluid/spray (37/64 [57.8%])

Table 15: Technician usage of nail clippers

NAIL CLIPPERS	RESPONSE
Do you use nail clippers	Yes 64/69 (92.8%) No 5/69 (7.2%)
How are these products used?	Reused with more than one client 69/69 (100%)
For tools that are reused, how are they cleaned between uses?	"Sterilised" using fluid/spray 37/64 (57.8%) Cleaned and disinfected 16/64 (25.0%) Disinfected without cleaning 5/64 (7.8%) Sterilised (using autoclave) 3/64 (4.7%) Dry wiped clean 2/64 (3.1%) Cleaned using detergent 1/64 (1.6%)

**MAIN POINTS (6)
TOOL USE**

Most technicians used non-metal files and buffers, and metal scissors, nail clippers and orange sticks and these were usually reused with more than one client. The most common way of cleaning these tools was with use of sanitising fluid/spray. Operators often referred to this method of decontamination as "sterilisation", although it is actually a method of sanitisation for hard (non porous) surfaces or skin.

Approximately two thirds of the technicians interviewed (47/69 [68.1%]) used wooden orange sticks and 40.4% (19/47) said they reused them with more than one client. The most common way of cleaning wooden orange sticks (if reused) was by using a sanitising fluid/spray (12/18 [66.7%]).

Most of the technicians interviewed (46/69 [66.7%]) used brushes for acrylic work and all of them reused them with more than one client. The most common way of cleaning brushes was by using EMA monomer (21/46 [45.7%])

Very few of the technicians interviewed (8/68 [11.8%]) used electric files or drills and all of them reused them with more than one client. The most common way of cleaning electric files or drills was by sterilisation using fluid/spray (4/8 [50.0%])

3.6 SELF REPORTED ILL-HEALTH SYMPTOMS IN NAIL TECHNICIANS

Mutually adjusted odds ratios for respiratory, musculoskeletal and skin symptoms (table 16) were derived for nail technicians and controls from logistic regression models adjusted for effects of age, smoking and years in industry. The nail salon technicians reported a significant increased prevalence of work related nasal symptoms compared to the control group (odds ratio=6.22 [95% CI 1.26-30.67]). A further significant difference was noted between self-reported work related neck, shoulder, wrist/hand problems, and lower back problems, with the nail salon technicians reporting a significantly increased prevalence of symptoms compared with the controls in each case (table 16). There were elevated levels of work related, self-reported, lower respiratory symptoms (cough and chest tightness), headaches, upper back and leg and feet problems in the nail salon technicians, compared with the controls. However, these were not found to be statistically significant. Eye irritation was the only condition that was reported by fewer nail technicians than controls. Regression analysis was not undertaken for wheeze as no controls reported work related wheeze. Unadjusted Fishers Exact test was not significant ($p=0.06$). Eczema of the hands, wrist and forearms was reported by roughly equal numbers of controls and nail technicians (22.2% (14/63) and 22.5% (16/71), respectively), however, 7.0% (5/71) of technicians reported work related eczema compared to none of the controls but this difference was not statistically significant (Unadjusted Fishers Exact test $p=0.06$).

Table 16: Ill-health symptoms in nail technicians

	Office based controls N=64	Nail salon technicians n=71	Odds ratio (95% CI)
Work related headaches Yes No	10/64 (15.6%) 54/64 (84.4%)	18/67 (26.9%) 49/67 (73.1%)	1.20 (0.46-3.13)
Work related neck problems Yes No	8/64 (12.5%) 56/64 (87.5%)	24/71 (33.8%) 47/71 (66.2%)	5.02 (1.61-15.62)
Work related shoulder problems Yes No	2/64 (3.1 5%) 62/64 (96.9%)	27/71 (38.0%) 44/71 (62.0%)	15.02 (3.14-71.84)
Work related wrist and hand problems Yes No	8/64 (12.5%) 56/64 (87.5%)	21/71 (29.6%) 50/71 (70.4%)	3.58 (1.20-10.66)
Work related upper back problems Yes No	3/64 (4.7%) 61/64 (95.3%)	16/71 (22.5%) 55/71 (77.5%)	3.94 (0.97-16.07)
Work related lower back problems Yes No	4/64 (6.3%) 60/64 (93.8%)	15/71 (21.1%) 56/71 (78.9%)	3.53 (1.0-12.54)
Work related leg or feet problems Yes No	1/63 (1.6%) 62/63 (98.4%)	5/71 (7.0%) 66/71 (93.0%)	5.57 (0.43-72.76)
Work related eye irritation Yes No	7/64 (10.0%) 57/64 (89.1%)	6/71 (8.5%) 65/71 (91.5%)	0.84 (0.22-3.17)
Work related nasal symptoms Yes No	2/64 (3.1%) 62/64 (96.9%)	15/71 (21.1%) 56/71 (78.9%)	6.22 (1.26-30.67)
Work related cough Yes No	1/64 (1.6%) 63/64 (98.4%)	7/71 (9.9%) 64/71 (90.1%)	4.22 (0.48-37.09)
Work related chest tightness Yes No	1/63 (1.6%) 62/63 (98.4%)	8/70 (11.4%) 62/70 (88.6%)	4.34 (0.49-38.33)
Work related wheeze Yes No	0/64 (0%) 64/64 (100%)	5/71 (7.0%) 66/71 (93.0%)	*
Work related eczema Yes No	0/64 (0%) 64/64 (100%)	5/71 (7.0%) 66/71 (93.0%)	*

*Regression analysis was not undertaken as no controls reported either work related wheeze or eczema. Unadjusted Fishers Exact test was not significant (p=0.06).

MAIN POINTS (7)

ILL-HEALTH SYMPTOMS IN NAIL TECHNICIANS

Nail salon technicians reported a significant increased prevalence of work related nasal symptoms compared to the control group (odds ratio=6.22 [95% CI 1.28-30.29]). A further significant difference was noted between self-reported work related neck, shoulder, wrist/hand problems, and lower back problems with the nail salon technicians reporting a significantly increased prevalence of symptoms compared with the controls in each case (table 16).

There were elevated levels of work related, self-reported, lower respiratory symptoms (cough and chest tightness), headaches, upper back and leg and feet problems in the nail salon technicians, compared with the controls. However, these were not found to be statistically significant. Eye irritation was the only condition that was reported by fewer nail technicians than controls.

Although 7.0% (5/71) of technicians reported work related eczema compared to none of the controls, this difference was not significant (Unadjusted Fishers Exact test p=0.06).

3.7 PROBLEMS WITH CLIENTS HANDS AND INFECTION CONTROL IN THE WORKPLACE

Most of the technicians interviewed (49/70 [70.0%]) had encountered clients with nail infections. In the main (77.5% [38/49]), technicians reported that they would not treat clients with nail infections on their natural nails and 57.1% (28/49) would also suggest that the client went to their GP. Only around a fifth of technicians (18.4% [9/49]) said that they would treat them and 1/49 (2%) said they would ask the client to sign a disclaimer first. A similar response was found when technicians were asked what they would do if clients had infection around artificial nails. Almost all (87.8% [43/49]) said that they would remove the artificial nail extension and recommend that the client saw their GP. 4/49 (8.2%) technicians said they wouldn't treat the client but would recommend that they saw their GP.

Technicians were then asked how they would deal with clients with warts, dermatitis or cuts and sores on their hands (table 17). The most common responses to dealing with clients with dermatitis or warts was for the technician to decline to treat the client (26.8% [19/71] and 23.9% [17/71], respectively) or work round the area (26.8% [19/71] and 16.9% [12/71], respectively). A number of technicians reported that they would recommend that the client visited their GP (11.3% [8/71] in each case)

When dealing with clients with cuts or sores, the most common response was for the technician to avoid the problem area (46.5% [33/71]), or cover the area with a sterile dressing or plaster (28.2% [20/71]). Only 1/71 technicians (specifically for warts) said that they would treat they clients in the same way as client with no skin problems.

Most of the technicians (85.9% [61/71]) reported that if the nail treatment caused the client's hands to bleed then they would stop the bleed, then clean and cover it with a sterile dressing/plaster. Generally, they would then either sterilise or disinfect the tool they had been using (66.2% [47/71]).

Table 17: Problems with client's hands

	RESPONSE
How would you deal with clients who come in with dermatitis affecting their hands?	<p>Would not treat the client (19/71 [26.8%]) Would work round area (19/71 [26.8%]) Would assess and then decide (18/71 [25.4%]) Would recommend that the client went to their GP (8/71 [11.3%]) Would only treat if client signed a disclaimer (2/71 [2.8%]) Never experienced this (2/71 [2.8%]) Record as contraindication and avoid area (1/71 [1.4%]) Apply skin care products (1/71 [1.4%]) No response (1/71 [1.4%])</p>
How would you deal with clients who come in with warts affecting their hands?	<p>Would not treat the client (17/71 [23.9%]) No response (15/71 [21.2%]) Would avoid wart area (12/71 [16.9%]) Cover with sterile dressing/plaster (11/71 [15.5%]) Advise the client to see their GP (8/71 [11.3%]) Never experienced this (4/71 [5.6%]) Would wear gloves (3/71 [4.2%]) Treat the client as normal (1/71 [1.4%])</p>
How would you deal with clients who come in with cuts and sores affecting their hands?	<p>Would avoid the problem area (33/71 [46.5%]) Cover with sterile dressing/plaster (20/71 [28.2%]) Would not treat the client (8/71 [11.3%]) Would wear gloves (5/71 [7.0%]) Advise the client to see their GP (2/71 [2.8%]) Never experienced this (1/71 [1.4%]) Would only treat if client signed a disclaimer (1/71 [1.4%]) Give full consultation prior to treatment (1/71 [1.4%])</p>
If a treatment causes a client's hand to bleed, how do you deal with the client?	<p>Stop the bleed, clean and cover with a sterile dressing/plaster (61/71 [85.9%]) Never experienced (6/71 [8.5%]) Apply resin to seal the cut (2/71 [2.8%]) Wash the area and advise the client to see their GP (1/71 [1.4%]) Give information on MSDS and advise to see their GP (1/71 [1.4%])</p>
If a treatment causes a client's hands to bleed how do you deal with the tools?	<p>Sterilise (by non-specified method) if metal, throw away if single use (32/71 [45.1%]) Put in Barbicide (14/71 [19.7%]) Sterilise (by non-specified method) (9/71 [12.7%]) Disinfect (6/71 [8.5%]) Dispose of tool (7/71 [9.9%]) Never experienced (1/71 [1.4%]) Clean the tools (1/71 [1.4%]) No response (1/71 [1.4%])</p>

MAIN POINTS (8)

PROBLEMS WITH CLIENTS HANDS AND INFECTION CONTROL IN THE WORKPLACE

Most of the technicians interviewed (70.0% [49/70]) had encountered clients with nail infections.

In the main (77.5% [38/49]), technicians reported that they would not treat clients with nail infections on their natural nails and 57.1% [28/49] would also suggest that the client went to their GP.

A similar response was found when technicians were asked what they would do if clients had infection around artificial nails. Almost all (87.8% [43/49]) said that they would remove the artificial nail extension and recommend that the client saw their GP. 2% (4/8) of technicians said they wouldn't treat the client but would recommend that they saw their GP.

The most common responses to dealing with clients with dermatitis or warts, was for the technician to not treat the client (26.8% [19/71] and 23.9% [17/71], respectively) or work round the area (26.8% [19/71] and 16.9% [12/71], respectively). A number of technicians reported that they would recommend that the client visited their GP (11.3% [8/71] in each case)

When dealing with clients with cuts or sores, the most common response was for the technician to avoid the problem area (46.5% [33/71]), or cover the area with a sterile dressing or plaster (28.2% [20/71]). Only 1/71 technicians (specifically for warts) said that they would treat the clients in the same way as client with no skin problems

Most of the technicians (85.9%) reported that if the nail treatment caused the client's hands to bleed then they would stop the bleed, then clean and cover it with a sterile dressing/plaster. Generally, they would then either sterilise or disinfect the tool they had been using (66.2% [47/71]).

4 DISCUSSION

4.1 DEMOGRAPHICS

We asked 588 nail salons to take part in this study, however, only 6.6% agreed to participate. Salon managers often said that they did not have time to take part in the study, or that they had already been visited by Local Authority inspectors. However, often no reason was given for non-participation. In compliance with ethics committee requirements, we did not make further enquiries of non-participant salons (such as demographic details or reasons for non-participation), therefore, we could not ascertain whether the low participation rate has led to a bias in the study population.

All 71 technicians who participated were female, so the controls were selected from 104 administration/non-laboratory female staff at the Health and Safety Laboratory. 64 (61.5%) controls agreed to take part in the study.

The controls had a higher median age (38 years) compared to the nail technicians (27 years). This difference in age may be due to chance or to nail work being a young new emerging industry. However, another explanation for the differences could be that nail technicians tend to leave the industry at an early age either for a change in career or due to health reasons. Further investigation would be needed to clarify this point. The smoking status of both populations showed no statistically significant differences.

4.2 REGULATIONS

The use of chemicals or other hazardous substances at work can put people's health at risk and employers are required to control exposure to hazardous substances to prevent ill health (Control of Substances Hazardous to Health Regulations 2002 [COSHH]). COSHH regulations apply to a number of potentially hazardous products used in nail salons (such as acrylic nail products, acetone and disinfectants) and most of the nail technicians reported that they were aware of COSHH regulations (although we have no information regarding their level of knowledge). Essentially, to comply with COSHH, the duty holder must assess the risks to health from hazardous substances, prevent or control exposure, ensure adequate control measures are used and monitor the exposure. Health surveillance should be carried out only where necessary and plans should be prepared which deal with accidents, incidents and emergencies. Employees should be appropriately informed of the main findings of the risk assessment and the precautions they should take to protect themselves and other employees.

Suppliers often use a material safety data sheet (MSDS) to set out the hazardous properties of their products, which would aid an employer in the risk assessment process. These sheets provide information about the health hazards, physical and chemical characteristics, first aid, and how to use the chemical safely. All potentially harmful products should be supplied with a MSDS or alternatively these can be requested from suppliers. However, the Chemicals (Hazard Information & Packaging for Supply) Regulations 2005 (CHIP) do not apply to cosmetics and therefore, suppliers of products that are subject to the Cosmetics Products Regulations that are used in the nail salons are not required by law to provide a MSDS. This may account for that fact that only approximately a third of technicians interviewed had any knowledge of MSDS. However, most of the technicians thought that their knowledge about the health and safety of products was good, which may have been because they generally looked at product labels, so would presume that they had all the information they needed.

Almost all of the technicians interviewed had received training on nail work. This was mainly through a college environment, but over half of the technicians had received training from current or previous employers. All of the technicians reported that their training included aspects of health and safety, which was reflected in the fact that nearly all of the technicians knew what COSHH regulations and risk assessments were. However, even though the technicians were aware of the regulations, we did not ascertain the extent of their knowledge, how it was put into practice and how to comply with COSHH regulations.

4.3 PRODUCT AND TOOL USE IN NAIL SALONS

Approximately a third of technicians used liquid and powder acrylic or UV/gel nail enhancement systems in their salons and most of them reported that they took steps to protect themselves from harm whilst using these products. Under COSHH, if an employer is unable to prevent exposure to the hazardous substance, then exposure needs to be adequately controlled by using appropriate work processes, systems and engineering controls. The technicians tended to say that they would use some form of ventilation to protect themselves from harm. Technicians often said they also used masks and gloves (or other means of avoiding contact with the product) as a protective measure. It is likely that the masks they use are general dust masks, which are unsuitable for control of exposure to vapours. Under COSHH suitable respiratory protective equipment (RPE) must be provided if, despite the precautions taken, exposure to respiratory hazards are not adequately controlled. Therefore in the hierarchy of control measures RPE is regarded as the last resort as a means of controlling exposure and should have the potential to provide adequate protection for individual wearers. The Approved Code of Practice (AcoPs) supporting COSHH, recommend fit testing of RPE however, it is unlikely that this occurred in the nail salons and the use of masks is not recommended in either the Habia Code of Practice: Nail Services. (Habia, 2007) or COSHH Essentials for services and retail (SR13) for nail salons (HSE, 2006). Glove use however, is recommended in COSHH essentials for handling nail products and solvents. Nail dehydrators are used when applying nail extensions to provide an oil free nail surface and are predominantly acetone based. Most of the technicians had read the product label and over half took steps to protect themselves from harm when using these products. This was done by avoiding contact with the product but also, once again, using ventilation and masks.

The Habia Code of Practice: Nail Services (Habia, 2007) states that reusable equipment should be cleaned and disinfected (or sterilised) between clients. Cleaning is essential before disinfection or sterilisation of instruments and equipment. Nearly all technicians used disinfectants and sanitising sprays in their workplace and this was the most common method stated for cleaning tools such as files, scissors and nail clippers. However, most technicians did not mention cleaning the tools before sanitisation, sterilisation or disinfection. There appeared to be a widespread misconception about the activity of liquid sanitisers, which were often referred to as “sterilising” agents with respect to decontamination of hands, tools or equipment. Such sanitising sprays do not sterilise but are supplied for rapid decontamination and disinfection of skin, hard (non porous) surfaces and absorbent (porous) surfaces. The main active ingredient in many sanitising liquids is ethyl or isopropyl alcohol (70%-90% solution in water). Some of the product details claim that they have broad-spectrum antimicrobial activity and are reputed to be effective against spores, mycobacteria, viruses including HIV, as well as bacteria and fungi, although they do not achieve the same level of decontamination as sterilisation. Like all disinfectants, they are only effective if used according to product directions but compared with the other products the survey asked about, a larger proportion (over a third of technicians) had not read the labels of disinfection and sanitising products. This is of concern as the effectiveness of such products are diminished if the product usage instructions are not followed exactly. Application brushes for acrylic systems are expensive and are not usually replaced until they are worn out, so the most common method of cleaning them is by using EMA

Non-metal files should ideally be disposed of after each client and not reused (Habia 2007). It is often a cost issue that the files are reused to avoid increasing salon prices. At some salons, files are given to the client to keep or retained for specific client use by the salon. However, the common practice in most salons is to reuse the files on more than one client until the file surface becomes ineffective, when it is disposed of and replaced. Most of the technicians re-used files and generally considered that they were effectively decontaminated by treating with sanitising fluid or spray without prior cleaning. As the surface of files is uneven and porous, it is unlikely that sanitising products would provide thorough sanitisation. However, the risk of cross-infection with these tools is likely to be very low as they do not come into contact with blood through normal use and salons tend to avoid treating clients with cuts or visible symptoms of infection on or in close proximity to the clients' nails.

4.4 EMA AND MMA USE IN NAIL BARS

EMA is classified under the EU Dangerous Substances Directive (67/548/EEC) as R36/37/38 (irritating to eyes, respiratory system and skin) and as R43 (may cause sensitisation by skin contact). MMA is classified as R37/38 (irritating to respiratory system and skin) and as R43 (may cause sensitisation by skin contact). Neither substance is classified as R42 (may cause sensitisation by inhalation).

HSE's Asthmagen's Compendium states that several cases of asthma associated with exposure to methyl methacrylate (MMA) have been reported. These are associated with occupations where workers are exposed to high peak levels of short duration. In such cases it is likely that irritation of the respiratory tract leads to asthmatic responses. In respect of a possible link between MMA use and asthma, the Compendium states that "There is not sufficient evidence to conclude that methyl methacrylate meets the revised EU criteria (1996) for classification as a respiratory sensitiser (a cause of asthma) and labelling with R42." It states that "Several cases of asthma associated with exposure to methyl methacrylate have been reported. These appear to be associated with "end-user" occupations where the pattern of exposure is characterised by high peak levels of short duration, and it seems likely that they represent asthmatic responses triggered by irritation of the respiratory tract. For some cases, exposure to substances other than methyl methacrylate was possible. Overall, there is no good evidence that methyl methacrylate is able to produce a hypersensitive state in airways".

Very few of the nail technicians interviewed used MMA in their workplace and over half were aware of advice or information advising against using acrylic nail products that contain MMA. This was mainly that it was a harmful substance and widely thought to be banned in the USA. The use of MMA as a nail extension fixative has decreased not only because of respiratory health concerns for staff but also because MMA nails are very rigid and do not bend or have the flexibility to break. If they are broken there is a risk of severe damage to the natural nail plate (Beauty for Nails, 2006). Also the adhesive properties of MMA extensions are very strong and MMA extensions cannot be soaked off with acetone, instead they need to be physically removed which poses the risk of temporarily or permanently damaging the nail plate. In contrast, the adhesive properties of EMA are weaker and is more easily removed by soaking the fingertips for up to two hours in acetone. Use of MMA may persist in some salons because of lack of knowledge and training and for financial reasons because MMA products are many times cheaper than those containing EMA (Beauty for Nails, 2006).

EMA is regarded as a potentially safer and better product than MMA. Two fifths of the technicians interviewed reported that they used acrylic nail products that contained EMA, but over a quarter didn't know if they did or not. This lack of knowledge was surprising as most technicians said that they read the product label. It could be that the label isn't sufficiently explanatory about the product ingredients, or is difficult to understand, but further investigation would be needed to clarify this. Generally, technicians said that they protected themselves from

harm whilst using these products by using ventilation, decanting products into smaller pots and by using gloves and/or masks. Current guidance recommends these steps, apart from protective masks, which are not recommended by the COSHH Essentials SR13 (HSE, 2006) or by the Habia Code of Practice Nail Services (Habia, 2007) for protection against inhalation of vapours from nail chemicals. These guidelines recommend that vapour production is kept to a minimum as the primary control method and that good ventilation should be provided if considered appropriate to further reduce dust and vapours. These recent guidelines also recommend the use of lined, lidded metal bins; keeping containers closed when not in use; quick disposal of gauze/tissues that are damp/wet with product; and also quickly mopping up any accidental splashes or spills of nail chemicals (Habia, 2007; HSE, 2006). The SR13 guideline also advises health surveillance for workers who use acrylic systems and UV nails (HSE, 2006).

4.5 NAIL INFECTIONS AND PROBLEMS WITH CLIENTS HANDS

The most common types of infections of natural nails are fungal, which present symptoms such as thickening and discolouration of the nail and nail bed. Bacterial nail infections are also relatively common and can occur when skin around the nail become damaged and allow bacteria to invade the tissue area. A characteristic blue/green bacterial infection (*Pseudomonas spp*) may occur if a moist space is accidentally formed under nail enhancements. Most of the technicians interviewed had encountered clients with some form of nail infection. The Habia Code of Practice: Nail Services (Habia 2007) suggests that nail technicians should not treat clients with nail infections, but should refer them to a GP. However, if a client has a nail infection under their artificial nail, then this should be removed and they should not have any further nail extensions until the infection has cleared. Generally, the nail technicians interviewed appeared to be adhering to this advice, as most reported that they would not treat clients with nail infections on their natural nails (but would remove artificial nails if the nail underneath was infected) and that they would recommend the client saw their GP.

4.6 INFECTION CONTROL

Blood borne viruses (BBV) are viruses that some people carry in their blood, which may cause severe disease in certain people and few or no symptoms in others. The main BBVs of concern are hepatitis B, C and D virus which all cause hepatitis (a disease of the liver) and human immunodeficiency virus (HIV), which causes acquired immune deficiency syndrome. In nail work, there is a risk, (albeit small with the work practices that have been described in these findings) that technicians could come in contact with blood or body fluids. Under COSHH, an employer should assess the risk of infection for employees and others as a result of their work practices and if a risk is known, then the employer should ensure that they take suitable precautions to protect their health and provide employees with adequate instruction and training on any risks to their health that they face at work.

When dealing with clients with cuts or sores, the most common response was for the technician to avoid the problem area or cover the area with a sterile dressing or plaster. Most of the technicians reported that if the nail treatment inadvertently caused the clients hands to bleed then they would stop the bleed, then clean and cover it with a sterile dressing/plaster. This occurrence is quite rare and less than a tenth of the study population had never encountered it. The majority of the study population said they would then either sterilise or disinfect the tool they had been using. However, the technicians' meaning of the word "sterilise" is likely to mean disinfect or sanitise in most cases, as the difference between the terms was poorly understood and most salons did not possess sterilisation equipment (such as an autoclave or bench-top steriliser). Nearly all of the technicians said that they thought that there was a risk of infection if the client's skin was cut or bleeding.

It is unlikely that blood borne or skin infections would be transferred from one client to another via metal nail tools, especially as correct procedure should not draw blood. The Habia Code of Practice (2007) states that disinfection is a sufficient level of infection control when skin is not cut or broken. An appropriate decontamination procedure would consist of physical cleaning (such as with a scrubbing brush using water and detergent) followed by appropriate disinfection using a proprietary disinfectant or alcohol-based solution (Habia, 2007). However, from the questions regarding tool use, it was found that many nail technicians did not physically clean the item before disinfection or sterilisation, although this is an essential step in the process.

Respondents seemed unsure of how to deal with clients who had hand warts since a fifth of the technicians gave no response and only 3 technicians said they would wear gloves. A further 11 technicians did suggest the alternative of covering the wart. It may be that the transmissibility of hand warts is not understood and that simple barrier methods will suffice.

4.7 SELF REPORTED ILL-HEALTH SYMPTOMS IN NAIL TECHNICIANS

Musculoskeletal problems

Nail salon technicians reported significantly elevated rates of work related, self-reported neck, shoulder, wrist/hand and lower back problems compared with the control group. Anecdotal evidence, and evidence collected during ergonomics assessment of comparable professions such as podiatry and chiropody (Lee and Jones, 2004), suggests that there is a significant link between the technicians' working practice and posture and the elevated rates of MSDs. Elevated levels of work related headaches, upper back and leg and feet problems were also found in the nail salon technicians, compared with office based controls. However, these were not found to be statistically significant. The lack of statistical significance in these findings could be attributed to the low recruitment attained which may have lead to type 2 errors, as the final numbers recruited were half that expected.

N.B. A type 2 error may be very simply explained as a false negative: that is, failing to show a significant difference when it really exists. A type 2 error is frequently due to sample sizes being too small (too few people surveyed).

While providing treatments the technicians assume compromised postures to gain access to the area of treatment, especially when performing visually demanding work resulting in increased forwards flexion of the neck and lower back. At the same time, given that the location of the site of treatment (the recipients' hands and fingers) is relatively fixed during the treatment, the hands, wrists and shoulders of the technician are positioned to gain access to the areas being treated. This leads to technicians assuming compromised postures such as elevation and abduction of the shoulders, flexion of the elbow and wrist and deviation of the wrist. Moreover, maintaining these static postures for considerable periods of time during each stage of the treatment leads to an increase in muscular fatigue due to the reduction in blood flow through the muscles that are in contraction (Kilbom, 1994).

Ergonomics literature, such as the HSE guidance on Upper Limb Disorders in the Workplace (HSE, 1998), discusses these common risk factors for the onset of MSD in terms of posture, repetition and duration of work, application of force and psychosocial issues and suggests that there is an increased risk of injury when there are a number of risk factors acting in combination. The work performed by the nail salon technicians does include a combination of these risk factors. An ergonomic assessment of work practices in this industry would enable identification of the working practices associated with musculoskeletal disorders. Once the causes have been identified then guidance and interventions could be put in place to minimise the impact of each of musculoskeletal risk factors and reduce the occurrence of this type of injury within the profession.

Airway symptoms

The findings (table 16) demonstrate elevated odds ratios for work related nasal and respiratory symptoms in nail technicians when compared to the controls with similar smoking habits. The extent of the conclusions that can be drawn from these findings are somewhat limited by the low participation rates, which may have introduced bias. As with the reporting of musculoskeletal problems, type 2 errors may have also introduced bias. It is also likely that the salons volunteered to take part in this study because they considered themselves to have good working practices and staff in reasonably good health. Despite these limitations, work related respiratory and nasal symptoms were more commonly reported in nail technicians, although this was only significant for nasal symptoms. The aetiology of such symptoms is not clear from this study as the risks relating to current use of EMA/MMA and exposure to airborne dust were not determined.

Skin symptoms

Five of the technicians and none of the controls reported work related eczema, although this difference was not statistically significant. Less than a third of technicians had experience of themselves, a colleague or a customer having problems resulting from products used for nail work and the respondents most commonly described these as skin problems. A quarter of nail technicians stated that they would not apply nail treatments to customers with dermatitis. However, equal numbers said that they would work around the affected area and again equal numbers would assess the situation and then decide whether to treat or not. This suggests that technicians may not understand the increased predisposition to irritant and allergic contact dermatitis of these clients.

5 RECOMMENDATIONS

Investigate the extent of the health and safety content of nail technician training and determine how it is applied in practice

Almost all of the technicians interviewed had received training from employers or colleges that included health and safety and nearly all of the technicians knew what COSHH regulations and risk assessments were. However, even though the technicians were aware of the regulations, we did not ascertain the extent of their knowledge, how it was put into practice and how much was understood about compliance with COSHH regulations. It would be helpful to make enquiries of colleges about how COSHH is taught on nail technicians training courses, to investigate the health and safety content of nail technicians training and to determine whether college leavers apply their knowledge to their subsequent work activities. Although technicians often reported that they read product labels, over a quarter of technicians reported that they did not know whether or not MMA was an ingredient in the products they used. This suggests that technicians may not fully utilise the information they read on product labels to help them assess the likely risks. To supplement the investigation of COSHH issues it would also be of interest to establish the usefulness of the information provided on product labels in helping nail technicians determine what actions they need to take to reduce exposure to any harmful substances.

Assess ergonomic aspects of working practices in nail salons to enable identification of working practices associated with risk factors for musculoskeletal disorders

Nail salon technicians reported significantly elevated rates of work related neck, shoulder and wrist/hand problems compared with the control group and evidence from the literature suggests that there is a significant link between nail technicians' working practice and posture and the elevated rates of MSDs. The work performed by nail salon technicians includes a combination of the documented risk factors for musculoskeletal injury. An ergonomic assessment of work practices in this industry would enable identification of the working practices associated with musculoskeletal disorders. Once the causes had been identified then further work could be considered such as guidance and interventions that could be put in place to minimise the impact of each of musculoskeletal risk factors and reduce the occurrence of this type of injury within the profession.

Establish levels of worker exposure to airborne particles in nail salons and effectiveness of ventilation systems for reducing exposure

This study found elevated risks for work related nasal and respiratory symptoms in nail technicians when compared to matched controls. This was only significant for nasal symptoms. The extent of the conclusions that can be drawn from these findings are somewhat limited by the low participation rates, also it is likely that only the best salons, who considered themselves to be without health problems, agreed to participate. Low recruitment may also have lead to type 2 errors as the final numbers recruited were half that expected. The aetiology of such symptoms is not clear from this study as the risks relating to current use of EMA/MMA and exposure to airborne dust were not determined. An investigation of worker exposure to dust and vapours in a number of nail salons and the type of ventilation used to reduce exposure is warranted by these findings. This activity would need to undertaken alongside an ergonomic assessment of the postures assumed by technicians, to establish whether the types of ventilation used did not contribute to the musculoskeletal disorders reported by technicians.

Establish why the working age of nail technicians was lower than that of controls

The controls had a higher median age (38 years) compared to the nail technicians (27 years). This difference in age may be due to chance or due to nail work being a young new emerging industry. However, another explanation for the differences could be that nail technicians tend to leave the industry at an early age for some reason, such as perhaps to pursue a different career or due to ill-health reasons. Further investigation would be needed to clarify this point.

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7 APPENDICES

APPENDIX 1: BRIEF DESCRIPTION OF NAIL ENHANCEMENT CHEMICALS AND THEIR USE

7.1 PRODUCT CHEMISTRY

These descriptions of product chemistry were taken from the text book by Schoon (2005) on nail structure and product chemistry.

Nail enhancements (also known as extensions, false nails or artificial nails) are produced by coating the natural nail with a hard coating of acrylic. There are many different products that may be used but they all share the characteristics that their constituent ingredients (monomers or oligomers) undergo a polymerisation reaction to produce a hard acrylic polymer coating – the nail enhancement. There are 3 main types of enhancement and all rely on acrylic monomers/oligomers:

- Natural nail overlays – coatings that cover the nail plate and do not extend the nail
- Tip and overlays – coatings which incorporate a plastic tip to extend the length of the nail
- Sculptured nails – coatings which extend the nail without using a plastic tip

Typical nail systems are tip adhesives, wrap resins, liquid/powder systems, UV gels, and no-light gels. All these systems involve the conversion of liquid monomers and/or oligomers into hard coatings via polymerisation reactions. Energy is required to stimulate the initiator chemicals and trigger the polymerisation reaction. Some systems require light energy (for example, UV) and others need heat. Heat from the room or the finger provides enough energy to start the reaction.

Liquid and powder systems are very commonly used and involve combining a liquid monomer (such as ethyl methacrylate monomer (EMA)) with a powdered polymer (typically poly methyl and/or ethyl methacrylate (PMMA, PEMA) that contains the reaction initiator and other ingredients, such as colorants. The most commonly used polymerising enhancement products can be divided into three main categories by the polymerising chemicals they contain:

- Cyanoacrylates – wraps, no-light gels, tip adhesives
- Methacrylates – monomer and polymer (“odourless” (i.e. low odour) and non-odourless), UV nail enhancements
- Acrylates and Methacrylates – UV nail enhancements

It can be seen above that UV-cured gel products use both methacrylate and acrylate monomers/oligomers and liquid and powder systems are based on methacrylate monomers. They all use polymerisation reactions to produce a cured resin coating, the main difference with UV gels is that they use UV rather than heat to cure. The term no-light gel is misleading as these products are actually a thickened cyanoacrylate resin rather than a UV gel that can be cured without light. Their mode of application is closely similar to a nail wrap.

There are advantages and disadvantages with each of the different acrylic systems regarding the individual chemicals they contain, the look of the finished product, the efficiency of the curing process and the relative hard-wearing of the final product, but no one enhancement product is safer or better for the natural nail than another when used properly.

Nail polishes (also known as nail varnishes, enamels, lacquers), topcoats and other nail treatments differ from enhancement systems because they form a hard coating by evaporation of solvents only and do not polymerise.

7.2 APPLICATION

Application of liquid and powder systems

- The nail plate is thoroughly cleansed, to provide a clean, dry, oil and debris free surface
- A primer solution may be applied to the natural nail to provide a surface with improved adhesion to the artificial nail overlay.
- A narrow brush is dipped into liquid monomer to allow sufficient product to be drawn up into the bristles
- The brush is then lightly dipped into the powdered polymer to allow a small bead of powder with a medium consistency (not wet) to be collected onto the end of the brush.
- The 'bead' of liquid and powder is applied to the nail and sculpted to form the desired enhancement shape, either with or without the use of a plastic tip.
- The approximate final sculpted shape must be achieved before the polymer cures to form a hard acrylic resin coating.

Application of UV nails

- The nail plate is thoroughly cleansed, to provide a clean, dry, oil and debris free surface
- A primer solution may be applied to the natural nail to provide a surface with improved adhesion to the artificial nail overlay.
- UV gel is applied directly to the nail with an applicator brush and sculpted into the desired shape
- The UV gel is cured under a UV light for the appropriate time to obtain a hard acrylic resin coating.

Application of Wrap systems

- The nail plate is thoroughly cleansed, to provide a clean, dry, oil and debris free surface
- Several thin layers of cyanoacrylate liquid/resin (monomer) are applied to the nail surface and reinforced with a layer of strengthening material, such as silk or fiberglass.
- A final layer of cyanoacrylate monomer is usually applied to seal in the strengthening nail coating.
- The layers are cured by applying a 'paint on' or sprayed accelerator that speeds up the polymerisation process.

Health and safety in nail bars

Background: Nail bars are a rapidly expanding small business sector. This project addressed Local Authority enforcement officers' concerns about the potential health risks involved with nail treatments and identified areas where further research is needed. **Methods:** 71 nail technicians answered a researcher-administered, self-reported occupational health questionnaire. Their data were compared with that from 64 control subjects. **Main Findings:** Nearly all the nail technicians interviewed had received training on nail work that included some aspects of health and safety. Compared with the control group, the nail technicians reported a statistically significant, increased prevalence of work-related symptoms, including nasal, neck, shoulder, wrist/hand and lower back problems. Compared with the control group, the nail technicians reported elevated levels of work-related lower respiratory symptoms, headaches, upper back and leg and foot problems. These were not statistically significant. Very few of the nail technicians interviewed used products containing methyl methacrylate (MMA) and over half were aware of advice or information discouraging the use of acrylic nail products containing MMA. Over a quarter of the nail technicians did not know whether the products they used contained ethyl methacrylate (EMA) or MMA.

Recommendations for further work: The extent of the health and safety content of nail technicians' training and its application in practice should be investigated. The increased prevalence of musculoskeletal disorders (MSDs), reported by the nail technicians in this study, is likely to be caused by working practices and posture. An ergonomic assessment of working practices in this industry is warranted to identify those associated with risk factors for MSDs. This study found a higher prevalence of work related nasal and respiratory symptoms in the nail technicians when compared to controls. An investigation of nail technicians' exposure to potentially hazardous dust and vapours is warranted by these findings. Such an investigation should also assess the effectiveness of ventilation systems for reducing exposure.

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