ORIGINAL ARTICLE

Intervention development in occupational research: an example from the printing industry

T P Brown, L Rushton, H C Williams, J S C English

Occup Environ Med 2006;**63**:261–266. doi: 10.1136/oem.2005.023523

See end of article for authors' affiliations

Correspondence to:
Dr T P Brown,
Epidemiology and
Statistics, Health and
Safety Laboratory, Harpur
Hill, Buxton SK17 9JN,
UK; terry.brown@hsl.
gov.uk

Accepted 6 January 2006

Background: Intervention development research is an essential prerequisite of any study that attempts to determine whether specific interventions work to prevent work related injury and illness.

Methods: Focus groups (n = 5) and direct observational studies (n = 21) of printers were used to elicit key issues that would aid the development of subsequent interventions. Transcripts from these were analysed by standard qualitative methods to identify common and related themes.

Results: The views of managers differed significantly from those of print workers in a number of areas, and working practices did not always follow policy. The majority of printers did not perceive dermatitis to be a major problem, although many complained of dry hands. Other key results included: the lack of skin care policy in most companies; poor understanding of the nature, causes, and treatment of dermatitis; low priority of dermatitis within health and safety concerns; little or no provision of occupational health services, particularly skin checks; variability in provision of and access to appropriate skin protection; and lack of accessible washing facilities.

Conclusions: As a result it was decided to evaluate the implementation of four interventions: provision of (1) skin checks and treatment advice; (2) gloves of the correct type and size, and use of an after-work cream; (3) information on dermatitis within the printing industry; and (4) development of best practice skin care policy.

The use of randomised controlled intervention trials to evaluate the effectiveness of drug therapy and other clinical procedures has been established in healthcare research for over 50 years. The necessity for similar studies has been increasingly recognised in the field of occupational health in the past two decades.¹ A review of occupational health and safety intervention studies published between 1988 and 1993² found that many of the studies had limitations in their design and implementation including no clear theoretical basis, inadequate sample sizes, uncontrolled sources of bias, and too short follow up time. The National Institute for Occupational Safety and Health (NIOSH) has been active both in developing a theoretical framework for occupational intervention research and in providing practical guidance.^{3–4} Three essential phases within intervention research are defined, namely development research, implementation research, and effectiveness research.³ Intervention development research is a necessary prerequisite to ensuring the success of the other phases and aims to systematically collate and analyse information on the current state of knowledge about the issue of concern, establish what changes are required and why, define the theoretical basis for the choice of intervention methods to implement, and develop partnerships with the target population.

This paper describes an intervention development study in the UK printing industry. The aim was to identify through qualitative research, a range of low cost, practicable, and acceptable interventions to reduce occupationally caused dermatitis with a view to informing the testing of such interventions in a subsequent intervention implementation research phase.

Occupational dermatitis in the printing industry

Occupational skin disease is a widespread problem in industrialised countries, and in the UK it accounts for about 20% of all cases of occupational illness.⁵ The UK Health and

Safety Executive (HSE) estimated in 2001/2002 that about 39 000 people in Great Britain were suffering from a skin disease caused by their work,⁶ and there are an estimated 4300 new cases diagnosed each year, of which approximately 80% were contact dermatitis.⁷ The economic impact is considerable and in the UK it has been estimated that there are about 237 000 days lost each year due to occupational skin disease, with an average of 8 days lost per case.⁶ Despite published figures indicating the magnitude of the problem, occupational skin disease is still likely to be under-reported, as was recently highlighted in a study of the printing industry.⁸

Printers have been reported to have a high incidence, of around 75 cases of dermatitis per 10 000 workers, with solvents, soaps, petroleum products, acrylates, aldehydes, and wet work suggested as the main causative agents.⁹ In a survey of 1495 members of the Graphical, Paper and Media Union in the printing industry in Nottinghamshire, UK,⁸ the prevalence of contact dermatitis was shown to be about 11%. In this study, the most commonly affected parts of the body were the hands, especially the fingers and finger webs, and forearms. The study found that 41% of respondents had suffered a skin complaint at some time. Prevalence was highest in workers involved in printing processes, although over 90% of them wore personal protective equipment such as gloves. Workers on other processes were also affected. A large proportion of those suffering also reported that work related substances appeared to aggravate a skin condition. A sample of those surveyed with self-reported current dermatitis and a sample of those who reported never having suffered a skin complaint were examined at skin clinics by a consultant dermatologist. All those self-reporting a current skin problem were confirmed clinically and 58% were thought to be occupationally related. In addition, 28% of those who reported they had never suffered a skin problem were diagnosed with occupational dermatitis that was probably associated with occupation.

METHODS

Two methods were used to elicit key issues that would inform a subsequent intervention study: focus groups and direct observational studies.

Focus groups

Five focus groups (two consisting of company managers; two of print workers; and one of health and safety officers) were arranged with the assistance of the British Printing Industries Federation (BPIF), the Graphical, Paper and Media Union (GPMU), and the Nottingham Print and Media Group. Each focus group consisted of 5–9 individuals, a facilitator, and a recorder. The facilitator acted to prompt and encourage discussion among the participants, and to ensure that opinions on and the attitudes towards relevant issues were obtained. The list of issues was developed after consultation with members of the study's steering committee, which consisted of individuals from the HSE, BPIF, GPMU, and British Skin Foundation, and included:

- Tasks and jobs carried out in the company and the variability due to individual work practices
- Changes in processes, substances used, and work practices, which would improve the work environment relating to skin care
- Use and acceptability of personal protective equipment and opinions of its effectiveness
- Attitudes to general health and safety, who should be responsible, who actually takes responsibility, and the tolerance of unsafe practices
- Provision of health and safety advice, including information packs and leaflets and opinions on its effectiveness
- Opinions on occupational health provision, what is/should be provided
- Beliefs on the occupational causes of skin complaints
- What is/should be done about this by management and workers
- Structure of the work organisation, and attitudes on the strengths and dissatisfaction with this.

The recorder was present to take notes of the discussion and ensure that all issues were addressed. Each focus group discussion was tape recorded and later transcribed.

Observational studies

Visits to print companies were made by a member of the research team (TB) to supplement the information collected through the focus groups using the same list of issues above. Forty one companies in Leeds, Bradford, and Leicester (areas with large numbers of printing companies) were identified through a number of sources including the HSE, BPIF, British Telecom Yellow Pages, and internet search engines. Of these, 12 refused to take part and there was no reply from eight.

Visits were made to 21 companies, which varied in size and the type of printing they undertook (table 1).

At each company, the aims and objectives of the study were explained to the company manager who then accompanied the research team member around the workplace to establish the range of processes used and tasks carried out. The researcher was then allowed to walk freely around the workplace and talk to the printers. In some larger companies, TB was accompanied because of safety aspects and areas of restricted access. The aim of these visits was to shadow workers in all areas (pre-press, printing, and finishing) during a typical work-shift to observe and record current work practices, both overt and covert. During the visits workers were asked about their beliefs about dermatitis, and its possible causes, working practices, company health and safety, and provision of personal protective equipment. Information was also collected on the range of substances (including chemicals) used, the organisational structure of the company, the health and safety policies, and implementation, including skin care and healthcare provision.

Notes were taken during the visits, as well as a taped description of the observations and any discussions held. These tapes were later transcribed.

Analysis

The transcriptions of the focus groups and observational studies were analysed by standard qualitative methods to identify common and related themes.¹⁰ The transcripts of the focus groups and observational studies were first annotated by marking up common themes. All information relevant to each theme was then identified and examined using the method of constant comparison, in which each item of information is checked and compared with the rest of the data to establish categories within themes. By repeating this process a "saturation" of themes is reached and the key issues and categories are defined.

RESULTS

It was clear from the focus groups and observational visits that the views of managers and health and safety officers differed significantly from those of print workers in a number of areas. It was evident that working practices did not always follow policy and the majority of workers interviewed did not perceive dermatitis to be a major problem. However, many complained of dry hands, a complaint that was corroborated when shaking hands with employees. Table 2 highlights some of the differences in opinion between managers and workers.

The results of the focus groups and observational visits could be grouped under a number of headings.

Health and safety beliefs

It was generally agreed that the most important health and safety issue was to ensure the print machines were running smoothly, all safety guards were in place, and that workers knew how to operate the machines in such a way as to prevent any physical injury to the worker. There was agreement about the processes and work practices within the industry that could give rise to skin problems, either by drying the skin out or removing oils from the skin. These included: the use of deletion fluid in plate making; solvent use to clean blankets; exposure to UV inks and light; exposure to starch based powder (used to prevent paper sticking together); handling of paper in finishing areas; use of harsh soaps and continual washing of hands; and not rinsing and drying hands thoroughly. However, occupational dermatitis was not perceived as a major priority in the printing industry, partly because it is not regarded as a litigation or compensation issue. Print workers were worried

Table 1 Types and number of companies visited

Type of company	Number visited
Sheet-fed lithographers	12
Web-fed lithographer	1
Combined web-fed and sheet-fed lithographers	3
Sheet-fed lithographer printing labels	1
Sheet-fed/web-fed lithographer, screen and dot-matrix printer	1
Flexographic printer	1
Screen printers	2

Table 2 Differences in opinion between managers and workers on various issues

Topic	Manager's view	Employee's view
Glove availability	Always made available Open to abuse	Not always accessible
Glove type/size	Provide what is required	Managers provide cheapest Managers buy one size Not always correct type available
Glove use	Workers refuse to wear Workers use incorrect type Workers roll cuffs up Workers incorrectly use	
After-work cream	Not supplied because workers would not use as "not a man thing!"	Believe should be supplied
Information	Provide Material Safety Data Sheets Pass everything on, but workers do not read More required Suppliers to provide information	Availability poor, managers did not pass them on Little on health problems, mainly safe handling and machine operation Too technical More required
Training	Give as much as possible	Only provided during induction
OH service	Would be desirable but thought to be a luxury	Would be desirable, but believed managers did not feel worth the expense
Washing facilities	Provided adequate facilities	Remote from machines
	Soaps used in consultation with workers	Soaps too harsh
Risk assessment	Did not undertake one	Managers are more reactive than proactive to risks

about their long term health resulting from continuous exposure to chemicals, particularly solvents, and would like more information on the chemicals used. Managers felt that the chemical suppliers should provide more practical information about possible harmful effects, over and above information required for the material safety data sheets. They felt that suppliers had a responsibility to their customers to provide this information and perhaps training packages also.

Health and safety arrangements

Health and safety arrangements varied between companies, with larger ones tending to have a specific individual responsible for the overall company health and safety, with representatives from the workforce in different areas of the company. The latter were the first point of contact when any problem or issue arose and also disseminated health and safety advice. However, in the UK the majority of printing companies are small-to-medium sized enterprises and do not have full-time health and safety managers; usually a designated worker is responsible for health and safety.

Although risk assessments had been carried out within some of the companies, some print workers felt that sometimes no action was taken, and as a result management sometimes tolerated unsafe working practices. They also felt there was a tendency for companies to react to situations rather than being proactive.

There was disagreement regarding the provision and use of health and safety information. Managers felt that a lot of time and effort was taken to find out what was required with regard to all aspects of health and safety. This was then passed on to print workers as memorandums, leaflets, or by word of mouth. However, they felt that print workers would rarely read anything given to them. In contrast, print workers reported that very little information was distributed by managers, especially HSE literature, although this would be read especially if it was thought to be to their benefit. There was also often very little formal health and safety training.

Participants had seen very little information about skin problems within the printing industry. Printer workers, especially, stressed that more information on the health effects of working in the industry needed to be produced. However, the managers felt that the simple provision of information would only be a first step. The information

needed to be incorporated into an effective training programme, which would require follow up and checking. Skin care is only a minor aspect of current health and safety training courses.

Print workers were open in their criticism of management whom they felt did not care and were not interested in their employees, and this was demonstrated through lack of information, induction training, and on-the-job training. Workers were told to "get on with it". Some drew attention to the benefits of a good supervisor who would provide training and advice on various issues, and would be prepared to take problems up with management.

Occupational health provision

In the UK, occupational health services are generally only provided by larger companies. Participants from companies who employed an occupational nurse and/or physician felt that this was an invaluable service, particularly for detecting problems early. Workers were also able to visit them on-site, thereby reducing time off work. The service generally provided medical check-ups and regular hearing tests, and also skin checks. First aiders were present in all companies but they were only trained to react to a situation rather than being proactive in promoting health and providing skin checks. All participants agreed that more occupational health provision would be desirable, and it was suggested that smaller companies could group together, perhaps through organisations like the BPIF, to obtain better access to occupational health.

Skin care provision

Skin care was not generally a matter of concern to most of the print workers; few knew the symptoms of dermatitis, nor how to treat it or prevent it from recurring. Workers might complain of having dry hands, but tended to trivialise its significance and would accept it as "something that came with the job". Even when employees were aware of some of the potential causes of skin problems, work practices did not always reflect this knowledge. The issue of personal protective equipment was a major topic of discussion, with managers reporting that everything that was required was provided, including barrier and after-work creams and gloves. However, not unexpectedly, this was not the view of the print workers.

Creams

Barrier creams were supplied by most companies, but both managers and printers tended to regard them as complete protection against chemicals. Some felt it was not culturally acceptable for a man to use them, although at one company printers were observed liberally rubbing cream into their hands and under their fingernails every time they walked past the container bucket. Some commented that they could cause irritation, especially those containing lanolin. Managers and print workers both agreed that their use aided the removal of ink from hands. After-work creams and moisturisers were rarely provided by the companies and most printers did not use them or would admit to using them, again feeling their use was inappropriate for men. Some provided their own or used one at home. All printers said it would be helpful if the company provided a cream for use at the end of the day.

Gloves

Gloves are used throughout the industry, but participants commented about the variability in the type and size provided, and their availability. Managers stated that print workers were advised on the type of glove to wear for specific tasks, but this advice was not always heeded, and also reported that gloves of various types, including linen, disposable latex surgical, heavier duty nitrile, etc were freely available in their companies for their employees to use, although some felt this policy was open to abuse by some workers. However, some managers admitted that they were not always sure a correct decision had been made on the appropriateness of gloves. It was unclear whether any of the companies had carried out an assessment of the correct glove for the different tasks, with most supplying surgical gloves and heavier nitrile gloves. The advice of their supplier was usually taken, although the supplier did not always know what chemicals were being used. Glove use was not generally enforced in companies.

Participating print workers reported wide variation on the availability of gloves. Some reported that they could always get a pair of gloves when required, as the store was always open and they were freely available. However, the majority reported that gloves were kept in a central store, which was not easily accessible, especially if the key holder was absent, particularly on night shifts. In some companies, the store was also remote from the print machines, so a print worker would have to leave his machine to obtain a new pair; a small supply was not provided near the machines. Print workers commented that there were occasions when the store had run out or did not have the correct size, and in these situations the printer would simply use an old pair or not use any at all. Often a variety of sizes were not provided. Printer workers also reported that companies might switch to a much cheaper glove than previously used, which could cause problems. However, many of the print workers agreed that the correct glove for a specific job was not always used even when the supply was good and the type available correct; many would select a disposable latex glove to wear as these made their tasks more dextrous.

At one company a printer was observed requesting a latex glove that he found comfortable to wear which was not the correct type of glove for the job he wished to undertake. No latex gloves were found and the printer was later seen wearing a heavier-duty glove that was actually more suited to the task. If a short or urgent task was being undertaken, such as a quick clean of the blanket (used to transfer the print image from the plate to the paper) or plate, the worker would not bother to wear a glove if one was not conveniently available. It was observed that two men doing the same job (for example, cleaning a blanket) on the same machine

might wear different types of glove. Some print workers did not wear any gloves at all, saying the chemicals had no effect on them, and that they did not suffer any skin problems. Managers commented that this was another area where education was required.

When using a gauntlet-type glove some printers would roll the cuff up to prevent the blanket wash dripping down onto their forearms. It was also noticeable that at some companies gloves were equally dirty on the inside and outside. In addition, when gloves were removed, contamination of the skin occurred because one gloved hand would remove the first glove and then the bare hand would remove this glove. Print workers were also observed wearing only one glove to clean a machine while using the other hand to hold on as they leaned over the machine. Individuals were also observed leaning over to clean or service the machine, increasing the possibility that any spilt chemicals would get onto their clothes and soak through to react with the skin on their thighs and legs. A few print workers complained that some of their colleagues were bad "house-keepers"—that is, they did not clean up spillages before they finished working on a machine. At no company were gloves cleaned once a job was completed.

When handling paper in the printing and finishing areas, surgical or linen gloves were often worn to keep the paper clean. Some workers had cut the finger tips off the linen gloves and put rubber thimbles on to enable them to handle and sort large quantities of paper. However, the majority of workers in the finishing areas did not wear any gloves and were observed to have dry hands and many paper cuts. Individuals also said that dust got into the cuts and irritated the skin further.

Managers reported that gloves were sometimes overused, even when they contained holes. Workers who used latex gloves commented that they ripped easily, and chemicals tended to degrade the glove, causing holes to appear during lengthy tasks. As a result they sometimes wore two pairs at the same time, especially during tasks that required some degree of dexterity.

Chemicals

In a number of companies, the solvent based blanket wash for cleaning the machines was kept in an open bucket, and when required rags were dipped into the buckets, squeezed, and then used to clean the machines. Gloved hands were therefore immersed in the solvent, shortening the break-through time of the glove. In other companies, the cleaner was applied to a rag via a small flexible bottle. The buckets were filled from larger containers, usually by pouring with the potential for splashes to occur. Sometimes a hand pump was used. Similarly, the smaller bottles were either filled directly from larger ones, or by using a pump. Isopropyl alcohol (used as a dampening agent) was also poured from large containers into machine reservoirs in some situations, giving rise to the possibility of splashes occurring.

Soaps

The soaps used varied between companies, but all workers said that the soaps had an added abrasive ingredient (for example, pumice, plastic beads, walnut shells) that facilitated the removal of ink, grease, oil, and other substances from the skin. One manager reported that his company had tested a variety of brands before they arrived at the one currently used, rejecting the harsher soap. Some companies supplied soaps that also contained a moisturiser. Some print workers preferred to use a mild soap and put up with the ink stains on their fingers. Bad practices were reported, as some printers were known to use the solvents to get the ink off their hands at the end of a shift, and then use an ordinary soap to wash their hands.

Box 1: List of key issues from the study

- Division of opinions on many issues between management and workforce
- Lack of skin care policy in most companies
- Poor understanding of the nature, causes, and treatment of dermatitis
- Low priority of dermatitis within health and safety concerns
- Little or no provision of occupational health services, and in particular skin checks
- Considerable variability in provision of and access to appropriate and effective skin protection, including gloves and creams
- Lack of accessible washing facilities

Facilities

Washing facilities varied between companies. One company provided "stations" close to each print machine, but most participants reported that facilities were only available in the general washrooms that were often some distance from the machines. Printer workers commented that they would like facilities nearer to the workplace with taps that could be turned on and off without getting them dirty. Many preferred to use hand towels rather than electric dryers, because the latter tended to dry the skin out more.

DISCUSSION

This study has clearly demonstrated the necessity of carrying out an in-depth exploration of the working practices, beliefs, and attitudes within a workforce before developing interventions for further testing. Box 1 highlights the problematic issues that would benefit from remediation.

Not surprisingly, as shown in table 2, there was often disagreement about skin care provision and policy between managerial staff and the workforce. However, this was not universally the case and we did visit one or two companies that had successfully developed and implemented a skin care policy. This had been achieved through the collaboration between workforce, health and safety officers, and managerial staff. This included, for example, testing different skin care products and discussion with the workforce as to which was preferred, and provision of hand washing facilities close to machines.

There was general agreement that more information should be provided on these issues and should be simple but informative and made available to everyone.

Interestingly, there is quite a lot of detailed literature on the potential hazards, including chemicals, of working in the printing industry, much of it developed by the UK Health and Safety Executive and by chemical manufacturers. However, our study has demonstrated that this is either not reaching the workforce, or it is not being read. This highlights the need to research the most appropriate methods of communicating health and safety messages. For example, the use of posters and short leaflets could be considered in readily accessible and visible places. Education and training (initial and ongoing) was a major concern of all participants and provision of information is key to this.

The printing industry in the UK and many other countries generally consists of a large number of small and medium sized companies carrying out diverse processes, with many having fewer than 10 employees. Management structures thus vary, with responsibilities for health and safety, training, and education being more clearly defined and delineated as company size increases. Dermatitis is currently not seen as a

Main messages

- This study has identified many critical themes, beliefs, and challenges with regard to occupational contact dermatitis in the UK printing industry.
- The study also identified a range of low cost, practicable, and acceptable interventions to implement.
- Dermatitis is currently not seen as a priority within the printing industry, which may be seen as one of the major barriers for implementing interventions.

Policy implications

- Intervention development research is necessary to ensure the success of other phases of intervention research (implementation and effectiveness research).
- Workplace intervention should involve both employers and employees.

priority within the printing industry, as this study has demonstrated, partly due to the higher priority given to more immediate hazards, for example from chemicals and machinery.

The study has also highlighted the advantages of developing partnerships with all stakeholders in order to integrate their perspectives³ and develop acceptable and practical risk reduction strategies. As a result of this study it was decided to evaluate the implementation of four interventions: Provision of (1) skin checks and treatment advice; (2) gloves of the correct type and size, and use of an after-work cream; (3) information on dermatitis within the printing industry; and (4) development of a best practice skin care policy.

The results from the implementation phase are reported in a separate paper.¹¹

The HSE currently has a target to reduce occupational health in the UK by 10% by 2008 and dermatitis is a focus health outcome. This study has identified many critical themes, beliefs, and challenges that will need to be addressed and overcome if this target is to be achieved.

ACKNOWLEDGEMENTS

The authors would like to acknowledge the assistance of the Graphical Paper and Media Union, British Printing Industries Federation, Printing Industry Advisory Council, Health and Safety Executive, and the companies who participated in the study.

Authors' affiliations

T P Brown, I Rushton, MRC Institute for Environment and Health, Leicester, UK

H C Williams, J S C English, Department of Dermatology, Queen's Medical Centre, Nottingham, UK

Funding: this study was jointly funded by the UK Health and Safety Executive and the British Skin Foundation

Competing interests: none declared

REFERENCES

- 1 **Kristensen TS**. Intervention studies in occupational epidemiology. *Occup Environ Med* 2005;**62**:205–10.
- 2 **Goldenhar LM, Schulte PA**. Intervention research in occupational health and safety. *J Occup Med* 1994;**36**:763–75.
- 3 **Goldenhar LM, La Montagne AD, Katz T, et al**. The intervention research process in occupational safety and health: an overview from the National

- Occupational Research Agenda Intervention Effectiveness Research Team. *J Occup Environ Med* 2001;**43**:616–22.
- 4 **Robson LS**, Shannon HS, Goldenhar LM, et al. *Guide to evaluating the effectiveness of strategies for preventing work injuries: how to show whether a safety intervention really works. 2001-119*. Cincinnati, OH: National Institute for Occupational Safety and Health, 2001.
 - 5 **Cherry NM**, Meyer JD, Holt DL, et al. Surveillance of work-related diseases by occupational physicians in the UK: OPRA 1996–1999. *Occup Med* 2000;**50**:496–503.
 - 6 **Jones JR**, Huxtable CS, Hodgson JT, et al. *Self-reported work-related illness in 2001/02: results from a household survey. SW10102*. London: Health and Safety Executive, 2003.
 - 7 **HSE**. *Health and safety statistics highlight 2001/02*. Bootle, UK: Health & Safety Executive, 2002:1–32.
 - 8 **Livesley EJ**, Rushton L, English JS, et al. The prevalence of occupational dermatitis in the UK printing industry. *Occup Environ Med* 2002;**59**:487–92.
 - 9 **Meyer JD**, Chen Y, Holt DL, et al. Occupational contact dermatitis in the UK: a surveillance report from EPIDERM and OPRA. *Occup Med* 2000;**50**:265–73.
 - 10 **Pope C**, Mays N. *Qualitative research in health care*, 2nd edn. London: BMJ Publishing Group, 2000.
 - 11 **Brown TP**, Rushton L, Williams HC, et al. Intervention implementation research: an exploratory study of reduction strategies for occupational contact dermatitis in the printing industry. *Contact Dermatitis*, submitted.

11th European Forum on Quality Improvement in Health Care

26–28 April 2006, Prague, Czech Republic

For further information please go to: www.quality.bmjpg.com

Book early to benefit from a discounted delegate rate