Knowledge, Attitude and Practice Regarding Organic Solvents among Printing Workers in Hong Kong

Ignatius Tak-Sun YU, Nga Lan LEE and Tze Wai WONG

Department of Community & Family Medicine, The Chinese University of Hong Kong, China

Abstract: Knowledge, Attitude and Practice Regarding Organic Solvents among Printing Workers in Hong Kong: Ignatius Tak-Sun Yu, et al. Department of Community & Family Medicine, The Chinese University of Hong Kong, China—To find out the prevalence of good knowledge, appropriate attitude and safe practice among printing workers exposed to organic solvents in Hong Kong, and to see if safe practice was influenced by the knowledge of and the attitude towards the harmful effects of organic solvents as well as other factors. The survey was conducted in a sample of 501 male printing workers from 28 factories in Hong Kong. The knowledge of and attitude towards the harmful effects of organic solvents, as well as the good practices adopted by the workers when handling solvents were explored using a questionnaire. Multiple logistic regression analysis was conducted to identify the major factors that influenced the knowledge, attitude and practice of workers. The prevalence of good knowledge, appropriate attitude and safe practice was low, being 20.4%, 38.4% and 22.0% respectively. Good knowledge was positively associated with awareness of the relevant legislation and past drinking behavior and negatively associated with current smoking. Appropriate attitude depended on having good knowledge and younger age. Safe practice did not depend on knowledge and attitude, but was positively associated with being informed of safety precautions and being supplied with chemical information by supervisors. The majority of workers believed that their employers, the Government and other statutory bodies should be responsible for providing information on chemicals. Front line supervisors have a pivotal role to play in improving safe practices of workers by informing them of the necessary precautions and supplying the relevant chemical information.

Key words: Knowledge, Attitude and practice, Organic solvents, Printing

The harmful effects of organic solvents on human health have been reported worldwide for several decades. Occupational health authorities around the world have established safety regulations and/or guidelines to limit workers’ exposures to solvents at the work site, both by controlling the air concentrations of solvents in the working environment and by helping workers to avoid unnecessary exposures through safe practices and personal protective equipment. Theoretically, safe practices depend on having an appropriate attitude towards the health risks associated with exposure to solvents, which in turn depends on knowledge about the danger and harmful effects of organic solvents. Millions of workers are occupationally exposed to organic solvents in the world, but little is known about their knowledge of and attitudes towards the effects of organic solvents.

We conducted a cross-sectional survey among printing workers, which is a major occupational group with substantial exposures to organic solvents in Hong Kong, to find out the prevalence of workers having adequate/good knowledge and appropriate attitude. Safe practices when working with solvents should be instrumental in reducing the burden of the harmful effects of organic solvents on workers’ health. The study aimed to examine whether safe practices had been adopted among solvent users and to see if safe practices were influenced by the knowledge of and the attitude towards the harmful effects of organic solvents as well as other factors.

Subjects and Methods

All 285 printing factories with more than 20 employees, registered with the Labor Department and running their...
businesses in Hong Kong, were invited to participate, but only 28 factories agreed to participate in the study. These factories employed a total of 2,684 workers and 984 of them were successfully interviewed with a structured questionnaire, giving a response rate of 36.7%. The neurological symptoms and their relationships to organic solvent exposures among the 762 male workers in this study group was reported earlier. For the group of male workers who used organic solvents in their jobs (N=501), further questions were included to explore the knowledge of and the attitude towards the effects of solvents, as well as the safe practices adopted by the workers.

Knowledge about the harmful effects of solvents was explored by asking the workers to identify the body parts/systems that were commonly affected by organic solvents. If the respondent gave an affirmative answer to both the nervous system and the skin, plus an affirmative answer to either the liver and/or the kidneys, he was assessed to have good knowledge about the harmful effects of organic solvents. Appropriate attitude was assumed if the respondent agreed that exposures to organic solvents were harmful to health. Essential good practices when handling solvents were explored and included: reading labels of containers, wearing gloves, washing hands before eating or drinking and covering the lids of containers after use. Safe practice was defined as adopting all 4 good practices to limit solvent exposure. [The relevant questions involved are given in the Appendix]

The workers were asked if they had heard of the relevant legislation governing the use of chemicals in industry (The Factories and Industrial Undertakings [Dangerous Substances] Regulations); whether they had attended courses on industrial chemicals; whether they had been given information and instructions on the use of chemicals and safety precautions by their supervisors or employers; whether they felt they had adequate knowledge about chemicals, and whether they felt the need to improve their knowledge on chemicals. Basic demographic information and personal habits were obtained. The actual source of information on chemicals, the institution/organization that the workers thought should be responsible for providing information, the preferred channel for knowledge acquisition, as well as the reasons for not using personal protective equipment were also explored in the questionnaire.

The proportions, with their 95% confidence intervals (CI), of subjects with good knowledge, appropriate attitude and safe practice were calculated. Multiple logistic regression analysis was conducted to identify the major factors that influenced the knowledge, attitude and practices of workers. Covariates were entered using the forward stepwise strategy for good knowledge and included: awareness of related legislation, attendance on courses, informed of safety precautions by supervisor, supplied with chemical information by supervisor, given instructions on chemical use on site by employer, told to be careful with chemicals by employer, basic demographic data and personal habits. For appropriate attitude, good knowledge was entered in the first step and the other covariates were selected by the forward stepwise strategy in the second step. For safe practice, both good knowledge and appropriate attitude were entered in step 1 and the other covariates in step 2 by the forward stepwise strategy. All statistical analyses were performed using SPSS for Windows version 11.0.1.

Results
The workers had a mean age of 33.5 (range: 16–70) and 57.7% of them were married. A quarter of them (25.2%) had not completed primary school education and 30.6% had finished secondary school education. Smoking status: 42.5% were current smokers and 9.2% were ex-smokers. Alcohol: 10.0% drank alcohol currently and 2.4% had done so in the past.

The skin was the most frequently cited organ for the harmful effects of solvents (72.9%). This was followed by the lungs (68.1%) and the nervous system (49.7%). Only 21.6% and 15.6% knew of the harmful effects of organic solvents on the liver and kidneys, respectively. According to the criteria given in the methods, 102 subjects (20.4%; 95% CI: 16.8%–23.9%) were assessed to have good knowledge about the harmful effects of organic solvents and 192 (38.4%; 95% CI: 34.1%–42.7%) had appropriate attitude towards solvents; 62% (309) felt that they had adequate knowledge on chemicals, but 73% felt the need to improve their knowledge. Table 1 gives the actual source of information on chemicals as well as the institution/organization that the workers thought should be responsible for providing information. The majority of workers obtained information on chemicals through informal sources (co-workers and mass media), but most of them believed that the information should be provided by more authoritative bodies, including their employers, the Labor Department and the Occupational Safety and Health Council (a statutory body responsible for promoting occupational safety and health in Hong Kong). Publications were the preferred channel of knowledge acquisition for 40% of subjects, and this was followed by talks (21%), television (19%) and audio-visual materials including audiotapes, slideshows and videotapes (12%).

Among the safe practices, 49.7% of subjects (246/495) read labels of containers, 75.6% (374/495) used gloves, 56.1% (276/492) washed hands before eating/drinking, and 85.0% (396/466) covered lids of containers after use. Good practice (i.e. adopting all 4 safe practices) was adopted by 22.0% of subjects (102/464; 95% CI: 18.2%–25.8%) when working with solvents. The most frequently cited reasons for not using personal protective equipment
Factors associated with good knowledge are shown in Table 2. Past drinkers were more likely to have good knowledge, whereas the opposite was true for current smokers. Awareness of the relevant legislation had an independent positive effect on good knowledge. Good knowledge had a positive effect on appropriate attitude (OR=3.13; 95% CI: 1.95–5.01; p<0.001). Age (in years) was the only significant factor affecting appropriate attitude after adjusting for good knowledge (OR=0.97; 95% CI: 0.96–0.99; p=0.002). Neither good knowledge nor appropriate attitude had a significant effect on safe practice. Being informed of safety precautions by supervisor and being supplied with chemical information by a supervisor were the two significant factors leading to safe practice after adjusting for good knowledge and appropriate attitude (Table 3).

Discussions

In this survey of printing workers in Hong Kong, the
proportion having good knowledge of and appropriate attitude towards organic solvents was low, being 20.4% and 38.4%, respectively. The proportion of workers adopting individual good practices varied between 49.7% and 85.0%. However, if safe practice was defined as adopting all of the 4 listed good practices, the proportion of compliance was again quite low (22%). Knowledge of the harmful effects of solvents affected the attitude towards solvents, but both knowledge and attitude had little influence on the adoption of safe practice in this study group.

According to our knowledge, this is the first report in the medical literature looking systematically into the knowledge, attitude and practice related to the use of organic solvents in the printing industry. Although millions of workers around the world use different types of chemicals on a daily basis, the literature on their knowledge of, attitude towards and practices related to chemicals is scarce. A number of studies related to the use of pesticides have been reported, but none of them have systematically analyzed the relationships among knowledge, attitude and practice. A survey of 130 pesticide users in the West Indies found that many were unaware that the skin and eyes were important potential routes of absorption. About half said they never or only sometimes understood the labels, and many of those who said they understood did not always follow the instructions. Quite a number of them smoked and ate food while using pesticides, and over 60% never wore protective clothing\(^{(13)}\). Perry and colleagues conducted telephone interviews with a randomly selected sample of 164 dairy farmers who were pesticide applicators residing in Wisconsin and found that knowledge levels were positively related to intentions, beliefs, and self-efficacy regarding use of personal protective gear, but were not significantly related to risk perceptions and peer norms concerning pesticide safety\(^{(19)}\). Elmore and Arcury conducted in-depth interviews with 20 Mexican male seasonal farm workers in North Carolina’s Christmas tree industry\(^{(15)}\). They found that most workers knew that pesticides could be harmful, and a perceived lack of control and health beliefs were salient factors that decreased workers’ use of safety practices. A study in the dry-cleaning industry using focus group discussions with owners and workers showed that, in general, health and safety issues were not of great concern\(^{(20)}\). Although workers expressed some anxiety about solvent exposure and burns, but most felt that these hazards were “just part of the job” and little could be done to improve health and safety on the job. Our study had the benefits of a large sample size that enabled us to analyze, in a more quantitative manner, the inter-relationships among the knowledge, attitude and practice related to organic solvents, as well as exploring other factors that might affect these outcomes.

Although only 20.4% of workers were assessed to have good knowledge about the harmful effects of solvents, 62% felt that they had adequate knowledge of chemicals, but 73% felt the need to improve their knowledge. There were no significant associations between good knowledge as assessed by our criteria and workers’ own perceived adequacy of, or need to improve, knowledge. Most workers (91%) believed that their employers, the Government Labor Department and the Occupational Safety and Health Council should be responsible for providing information on chemicals, but very few of them (8%) actually obtained information from these sources. A lot more work would need to be done by the employers and the statutory bodies to lessen this gap and improve the knowledge on chemical hazards among front line workers. Contrary to the common belief that television is the most preferred channel of communication, most workers preferred publications and talks as the means of obtaining further knowledge on chemicals. In fact, in a study looking into the effects of television programs on child safety, the investigators could not find any significant association between the number of programs followed by the parents and the safety measures undertaken in the homes as a direct consequence of the programs\(^{(17)}\). There was also no significant association between the number of programs viewed and parents’ attitudes towards risks. Running educational programs on television is very expensive and has been a major means of promoting occupational health and safety in Hong Kong. However, there is no evidence to support its effectiveness over publications and talks, which were the preferred means of knowledge acquisition among the printing workers in this study. Almost a quarter of the workers did not use any personal protective equipment (PPE) at work and interference with work was the most common reason offered. Compliance with prescribed PPE would be improved if more attention were given to the design so that interference with work and discomfort could be minimized.

Having good knowledge was positively associated with an awareness of the related legislation and being an alcohol drinker in the past. The former association reinforced the importance of having regulatory control over the use of chemicals in industry and the roles of the statutory bodies in providing relevant information to the workers. Past alcohol drinkers had given up drinking and could possibly have experienced the side effects of alcohol (also an organic solvent) and might became more knowledgeable about the harmful effects of organic solvents. Smokers, in particular current smokers, had poorer knowledge and this could be the result of their general risk-taking attitude in life.

Safe practice was positively associated with being informed of safety precautions and being supplied with chemical information by supervisors. Such associations
emphasized the important roles played by front line supervisors in health and safety at the workplace. Specific chemical information related directly to workers’ job and workplace would likely be more relevant in improving safe practices than general knowledge about industrial chemicals. Direct safety instructions and supervisions at the worksite would be more effective in ensuring safe practices. Although the traditional health education model emphasizes the sequence of imparting knowledge, changing attitudes and altering behavior, this is often not the case in actual practice. For example, McIntosh and co-workers showed that awareness of the dangers of improperly cooked hamburgers, knowledge of specific food-borne pathogens and knowledge of food safety practices had no effect on willingness to change behavior\(^{10}\). It is also well known that the use of seat belts in cars depends more on legislation and law enforcement than on adequate knowledge and appropriate attitude.

The low response rate might be a concern, but it should not affect the internal validity of our study. Some workers were absent at the time of the fieldwork. Quite a number of workers refused to participate, but the underlying reasons were unclear. They might be afraid of having abnormalities detected during the survey, which they believed would jeopardize their employment. Participating companies might represent the better end of the spectrum in terms of safety management, supervision and safe practices. Similarly, respondents might have better knowledge than the non-respondents within the companies and be more likely to adopt good practices. Hence, the proportions of workers with good knowledge, appropriate attitude and safe practice could have been over-estimated.

The usual limitations of a cross-sectional study also apply to this study. We cannot make any conclusions as to the cause-effect relationships on the associations identified. Good and safe practices depended on the self-reporting of workers and could be inaccurate—those who had better knowledge and appropriate attitude would be more likely to provide affirmative answers to the list of good practices. If this were the case, we would have seen good knowledge and appropriate attitude being identified as important factors contributing to safe practice. However, such associations were not seen.

The results of our study have important implications for the practice of occupational health and safety, especially in industries or occupational groups dealing with chemicals. Employers, the Government and other relevant statutory bodies should play a more active role in improving the knowledge of workers dealing with chemicals. Television programs might only improve the general awareness, but workers using chemicals in their job would probably require more elaborate and concrete information to be communicated in the form of publications and talks. Safe practice does not necessarily depend on good knowledge and appropriate attitude of the workers. Front line supervisors can improve safe practices of workers by informing them of the necessary precautions and providing them with the relevant chemical information.

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Appendix: English version of the original questions used to assess knowledge, attitude and practice regarding organic solvents among printing workers:

Knowledge
Which body system(s) or organ(s) do you think organic solvents will affect?
Liver
Lungs
Kidneys
Skin
Heart
Circulatory system
Digestive system
Nervous system
Skeletal system

Attitude
Do you think that exposure to organic solvents has any harmful effects on health?

Practice
Do you read labels on containers of chemicals?
Do you wear gloves when working with chemicals?
Do you wash hands before eating or drinking after work?
Do you cover the lids of containers after using organic solvents?