

ORIGINAL ARTICLE

Why do workers behave unsafely at work? Determinants of safe work practices in industrial workers

A M Garcia, P Boix, C Canosa

Occup Environ Med 2004;**61**:239–246

See end of article for authors' affiliations

Correspondence to:
Dr A M Garcia, Facultad de Ciencias Sociales, University of Valencia, Avda. Tarongers s/n, Valencia 46022, Spain; anagar@uv.es

Accepted 11 March 2003

Aims: To explore the relation between safety climate (workers' perceptions regarding management's attitudes towards occupational safety and health) and workers' behaviour at work.

Methods: Cross sectional survey of workers at the pottery industry in Castellon, Spain. Sampling was stratified by plant size and workers' gender, according to data on the working population at this setting. A total of 734 production workers were interviewed. Information was collected on safety climate and workers' behaviour towards occupational risks with a specific questionnaire. A safety climate index (SCI, scale 0–100) was constructed adding scores for each item measuring safety climate in the questionnaire. Workers' unsafe behaviour was analysed for the different safety climate index levels.

Results: Mean score for SCI was 71.90 (SD 19.19). There were no differences in SCI scores according to age, gender, education, children at charge, seniority at work, or type of employment. Small workplaces (<50 workers) showed significantly worse SCI (mean 67.23, SD 19.73) than the largest factories (>200 workers). Lower levels of SCI (SCI <50) were related to workers' unsafe behaviours (full/high accord with the statement "I excessively expose myself to hazards in my work", adjusted odds ratio ORa 2.79, 95% CI 1.60 to 4.88), and to lack of compliance with safety rules (ORa 12.83, 95% CI 5.92 to 27.80).

Conclusions: Safety climate measures workers' perception of organisational factors related to occupational health and safety (for example, management commitment to risk prevention or priorities of safety versus production). In this study these factors are strongly associated with workers' attitudes towards safety at work. Longitudinal studies can further clarify the relation between safety climate and workers' behaviour regarding occupational safety and health.

Workers' perceptions and experience in relation to occupational health and safety are scarcely considered in programmes for the prevention of work related injuries and diseases. Healthy environments and healthy behaviours are key determinants in occupational health. Workplace environment includes physical as well as organisational factors, and attention and interventions should be focused on both. In fact, in post-industrial societies physical environments are now less strenuous and dangerous than before, while organisational threats are becoming more relevant in many workplaces. Organisational factors largely concern the design, management, and organisation of work.¹

Interventions over workers' behaviour intended to risk prevention are usually based on specific training programmes. These programmes are generally devoted to increasing workers' knowledge of job hazards and promoting safer work behaviours.² However, workers' behaviours regarding risk prevention are influenced by other factors besides proper training, and these factors should be evaluated and their relative effects on the workers' behaviour measured in order to develop integral programmes for workplace hazards control. Organisational factors related to safety and health at work, including management's policies and practices regarding occupational risk prevention, have been shown to affect implementation of workers' safety training.³

There is an interesting hypothesis linking organisational and behavioural determinants of occupational health based on the concept of safety climate (the employees' perception of the organisational culture and practices regarding safety at their companies, or their companies' safety culture). In 1980 Zohar⁴ introduced this concept in industrial organisations, defined as the summary of molar perceptions that employees share about their work environments. According to these perceptions, the workers develop coherent sets of expectations

regarding behaviour-outcome contingencies and behave accordingly. Zohar identified two main influential climate dimensions in determining safety climate levels: relevance of safety to job behaviour (including workers' perceived importance of safety training and workers' perceived effects of required work pace on safety); and workers' perceived attitude of the management towards safety. Some studies have evaluated safety climate in relation to safety levels in the workplace,^{4–5} judgement of risk among employees,⁶ and accident rates.^{7–8} A number of studies have also focused on the relation between healthcare workers' perceptions of their organisation's prevention programmes and compliance with universal precautions.^{9–10}

In Spain there has been some recent increased effort to improve occupational health and safety, in particular since Law 31/1995, on the Prevention of Occupational Risks, was approved.¹¹ However, occupational safety in Spain does not appear to have improved very much in recent years.¹² The determinants of safe behaviour among Spanish workers have been scarcely investigated in Spain. The present study was carried out in a large sample of Spanish industrial workers in the pottery industry with the aims of describing workers' behaviour towards occupational risk prevention and exploring the relation between safety climate perceptions and workers' behaviour regarding safety and health at work. The hypothesis that more favourable safety climate perceptions are related to safer behaviour among the workers was evaluated.

METHODS

The study was carried out in Castellon (province located in the north of the region of Valencia), a main location of the pottery industry in Spain. The population to be sampled included all production workers in the pottery sector working

Main messages

- Occupational accidents and diseases are major public health problems even in post-industrialised countries, in which profuse occupational health and safety regulations and preventive interventions at the workplace level have been developed in the past few years.
- Workers' behaviour towards occupational hazards is related to occupational health and safety.
- Besides physical environment and workers' training, organisational factors are likely to be related to workers' behaviour towards safety, but research and interventions at this level are still scarce.
- Results from this study show that safety climate, defined as the worker's perception of organisational factors related to safety and health at work (such as perceived management attitudes towards safety and its relevance to general production processes), is strongly related to workers' behaviours towards safety.

in plants located in the province of Castellon. Sample size was estimated in 700 interviews for $p = q = 0.50$ (p = prevalence of an attribute, $q = 1 - p$), 95% confidence level, and statistical error ± 0.038 . Available data on the working population at the pottery industry in Castellon allowed stratification of sampling proportionally by plant size (a maximum number of workers by plant was established in order to avoid a biased effect of a particular plant on the results) and workers' gender. However, it was not possible to obtain a pottery workers' census, and several complementary strategies were implemented in order to attain the estimated number of interviewees. Most of the sample (80%) was reached through random selection of households in the municipalities of the province of Castellon where the pottery industry is concentrated (Onda, Alcora, Vila-Real, and Nules). These households were directly visited by the interviewers, and replaced according to a previous established scheme when it was not possible to find or to interview a pottery worker in the house. This approach became extremely difficult at the end, and it was complemented with random selection of pottery workers located in cafés and restaurants at the industrial settings (15%) and at the exit doors of selected plants (5%), always according to previously established sampling strata. Before interview the workers were informed of the general aim of the survey and their participation in the study was fully voluntary. Confidentiality of collected data was guaranteed to participants. The non-response rate for eligible workers was 15%. All the interviews were face to face, performed by six experienced and previously trained interviewers. Interviews were performed in January and February 2001.

A questionnaire was designed, asking for information on safety climate and workers' behaviour towards occupational risk prevention. The questionnaire was mostly based on similar tools from previous research on the safety climate.³⁻⁷ A final version of the questionnaire was obtained after discussion and revision by the research team and other close colleagues; as it seemed to be easily understood by the workers in the first interviews and no problems were detected according to the interviewers, we decided not to introduce any additional change to it.

Items in the questionnaire were grouped in three main categories: safety climate (1 general item and 10 specific items), workers' behaviour related to health and safety (items 12–28), and workers' health and safety training (items

Policy implications

- In order to reduce the number of accidents and diseases related to work, organisational factors should be taken into account.
- Strong and true management commitment to occupational health and safety should be present and effectively perceived by the workers in the companies in order to improve workers' behaviours towards safety.
- Attempts to improve occupational health and safety at the workplace without first securing sincere management commitment to risk prevention are likely to fail.

29–30). All the items had closed questions, with different options for answers depending on the nature of the question: yes/no, 4-point, and 0–10 scales for the interviewee's level of accord, selection from a fixed list of causes for specified behaviours, and frequency for some behaviours (5-point scales). In the Appendix the items in the questionnaire and their different options for answers are presented. In the questionnaire data were also collected on workplace size (number of employees), job category (unskilled workers, skilled workers, supervisors), type of employment (fixed, temporary contracts), time working in the pottery industry, and personal variables (age, gender, education (number of years), children in their charge (yes/no), and nationality). Most of the workers (98%) were of Spanish origin, so nationality was not further included in the analysis.

Descriptive analysis of the items in the questionnaire was performed. The safety climate was analysed through a composite index for safety climate (safety climate index, SCI) created by simply adding accord scores for each specific item for safety climate (items 2–11). As these 10 items were each answered on a scale of 0–10, the SCI range was 0–100. For some analysis, SCI was a priori categorised in three categories (<50 , 51–69, ≥ 70), in cut points of well known relation with school marks in Spain (<5 , "fail"; ≥ 7 "good" or "very good"). The SCI showed high internal consistency (Cronbach's alpha 0.91). The items "I excessively expose myself to hazards in my work" (item 18) and "During the last three months, I have fulfilled safety rules doing my job" (item 26) were considered a priori key summary questions for evaluating workers' behaviour regarding health and safety at work and were specifically analysed in relation to safety climate perception and the remaining information in the questionnaire. Workers' self assessment of level and sources of training on safety and health was also analysed (items 29–30).

Means among categories for the variables were compared through unpaired *t* tests and one way analysis of variance. The level for statistical significance was established at 0.05. Unconditional logistic regression models were constructed to explain workers' behaviour in relation to safety climate perception and other information. Restricted models were obtained from full models using the likelihood ratio test for sequentially comparing nested models, variables being excluded when statistical significance for the likelihood ratio test was greater than 0.1. Odds ratios and 95% confidence intervals were obtained for explicative variables in the model. All analyses were performed using Stata statistical software.¹³

RESULTS

A total of 734 workers were interviewed (table 1). Mean age of the workers was 34.1 years (SD 10.4, range 16–64 years).

Table 1 Distribution of interviewed workers; pottery industry, Castellon (Spain), 2001 (n=734)

	n	(%)
Age		
16–25 years	177	(24.1)
26–30 years	140	(19.1)
31–40 years	214	(29.2)
≥41 years	203	(27.6)
Gender		
Men	696	(94.8)
Women	38	(5.2)
Education		
<8 years	281	(38.3)
8 years	286	(39.0)
9–12 years	113	(15.4)
>12 years	54	(7.3)
Children in their charge		
Yes	368	(50.3)
No	363	(49.7)
Workplace size		
<50 workers	105	(14.3)
51–200 workers	336	(45.8)
>200 workers	293	(39.9)
Time working in the pottery industry		
<1 year	57	(7.8)
1–3 years	149	(20.3)
>3 years	528	(71.9)
Job category		
Unskilled	557	(75.9)
Skilled	114	(15.5)
Supervisors	63	(8.6)
Type of employment		
Fixed	607	(82.7)
Temporary	127	(17.3)

Most of the workers had primary education or less (up to 8 years, 77%). Most of the plants were medium or large sized (more than 50 workers, 86%). A large number of interviewees had been working in the pottery industry for more than three years (72%); most were unskilled workers (76%) with fixed contracts (83%). Workers with and without children in their charge were equally distributed (50%).

Safety climate was first evaluated through level of accord (scale 0–10) with the first item in the questionnaire: “In my company workers’ health and safety are sufficiently protected”. Global mean for safety climate was high (mean 6.8, SD 2.2). Only 10% of interviewees rated their companies under 5, while 43% gave ratings over 7. Mean levels of accord (scale 0–10) with specific items composing the safety climate dimension (items 2–11) ranged from 6.2 (SD 2.8) for item 2 (“Productivity and safety at work are equally important”), to 7.7 (SD 2.5) for item 11 (“I have received adequate equipment for personal protection”). Higher levels of accord were also related to the presence of explicit rules for safety (item 9, mean 7.5, SD 2.5), while item 7 (“There are persons exclusively devoted to health and safety”) was found among the items with a lesser degree of accord (mean 6.5, SD 3.3). The distribution of valid responses to items 2–11 ranged from 83% to 100% for the total of interviewed workers.

Safety climate index (SCI, summary of answers to items 2–11) ranged between 0 and 100, with 590 observations (workers with valid answers for the 10 items composing the index). Mean SCI was 71.90 (SD 19.19), median was 75 (coefficient of skewness -0.7816 , normal distribution rejected). SCI was analysed for personal and occupational variables (table 2). Workers in smaller plants and unskilled and skilled workers (as compared to supervisors) presented significantly lower ratings for the safety climate index, while

no major differences or clear trends were observed for the remaining variables. Female workers ($n = 38$) tended to rate SCI lower than males, but this difference did not reach statistical significance.

Workers were asked if they have ever had a set of safety behaviours regarding risk prevention at work (items 12–17). Most of the workers (97%) confirmed they had had at least one of these actions, the more frequent actions being warning other workers about health and safety risks (item 15, $n = 631$, 86%), reporting hazardous conditions to the supervisors (item 13, $n = 571$, 78%) and asking for personal protection equipment (item 14, $n = 545$, 74%). More proactive actions, such as making suggestions (item 12) or asking for health and safety information (item 16) were less frequent, respectively quoted by 50% and 36% of the interviewed workers. Twenty four per cent of the workers had had contact with their representatives because of health and safety problems (item 17).

A substantial number of workers “fully” or “highly” agreed with the statement “I excessively expose myself to risks while working” (item 18, $n = 190$, 26%). Answers to this question and to the following items assessing the reasons for safe behaviour at work (items 19–25) varied considerably in relation to safety climate perceptions. Table 3 presents answers to these items in the three categories of SCI. For workers rating low safety climate index, the exposure to factors hampering safe behaviour was much more frequent than for workers perceiving high rates of SCI, the differences being statistically significant for all the situations described in the questionnaire.

Most of the workers affirm to work “always” or “almost always” according to safety rules (item 26, $n = 626$, 86%). This behaviour did not significantly vary in relation to age, gender, education, workplace size or type of employment. However, workers with more than one year and less than three years of experience in the pottery industry showed significantly lower frequency of safety rules compliance (78%) than workers with less (86%) and more experience (86%) ($p = 0.019$). Among workers fulfilling safety rules “always” or “almost always” ($n = 626$), the more frequently quoted reasons for this behaviour were personal conviction of its importance (90%), mandatory compliance of rules (49%), and supervisors’ control (30%), while reasons stated among workers not “always” fulfilling safety rules ($n = 330$, summary of subjects answering “almost always”, “sometimes”, “almost never”, or “never” to item 26) were preference for own strategies (49%), annoyance (36%), and the incompatibility of these rules with production requirements (35%). On the other hand, frequency of safety rules compliance varies significantly according to safety climate: for workers qualifying safety climate index as high (SCI ≥ 70), medium (SCI 50–69), or low (SCI < 50), those fulfilling safety rules always and almost always were 96%, 79%, and 68%, respectively ($p < 0.001$).

A large majority of the workers self evaluate ≥ 7 (scale 0 to 10) their training in health and safety (item 29, $n = 607$, 83%). Only 2.2% of the workers ($n = 16$) rated themselves below 5. According to the answers given by interviewees (item 30), own experience was the main contributor to health and safety training (quoted by 84% of the workers), followed by other workers’ support (54%). Training courses, safety rules or newsletters, and health and safety technicians appeared to be the less decisive factors for proper training according to the workers’ responses (respectively quoted by 30%, 20%, and 12% of the interviewees).

The answers to two key items in the questionnaire were analysed in multivariate models: unsafe behaviour (responses to item 18, “I excessively expose myself to risks while working”, full/high accord versus low/none accord);

Table 2 Mean and median for the Safety Climate Index (summary of answers to specific items for safety climate, items 2–11) according to personal and occupational variables; pottery industry, Castellon (Spain), 2001 (n = 590, number of interviewees with valid responses for the 10 specific items)

	Mean	(SD)	p	Median
Age				
16–25 years	70.86	(19.47)		76
26–30 years	72.90	(20.00)		76
31–40 years	72.52	(18.60)		74
≥41 years	71.42	(19.19)	0.807	74
Gender				
Men	72.15	(18.99)		75
Women	65.83	(23.15)	0.114	69.5
Education				
<8 years	73.70	(19.44)		77
8 years	70.19	(18.54)		72
9–12 years	72.57	(18.36)		75
>12 years	69.54	(22.89)	0.210	75
Children in their charge				
Yes	71.87	(19.63)		74
No	71.86	(18.81)	0.994	76
Workplace size				
<50 workers	67.23	(19.73)		70.5
51–200 workers	70.37	(18.81)		74
>200 workers	74.83	(18.98)	0.002	78
Time working in the pottery industry				
<1 year	69.30	(22.69)		75
1–3 years	69.62	(18.73)		70
>3 years	72.70	(19.01)	0.223	75
Job category				
Unskilled	70.95	(19.32)		74
Skilled	71.52	(19.37)		74
Supervisors	80.90	(15.28)	0.002	84
Type of employment				
Fixed	71.81	(19.43)		75
Temporary	72.40	(17.93)	0.787	75.5

and safety rules compliance (responses to item 26: “During the last three months, I have fulfilled safety rules doing my job”, sometimes/never versus always/almost always) (table 4). The only significant determinant of workers’ behaviour regarding self exposure to risks and lack of compliance of safety rules at work is the safety climate index. There was no other variable in the models significantly associated with either of the two behaviours. In fact the answers to these two items were highly correlated ($\chi^2 = 54.54$, $p < 0.001$). For workers rating safety climate index at their workplaces as low (SCI <50), the adjusted odds ratio for exposing themselves to occupational risks always or almost always was 2.79 (95% CI 1.60 to 4.88), and for lack of compliance with safety rules the adjusted odds ratio was 12.83 (95% CI 5.92 to 27.80).

DISCUSSION

Safety climate measures the employees’ perception of safety culture at their companies. According to our results, safety climate is strongly related to the workers’ behaviour towards safety and health at work. The safety climate concept was first proposed by Zohar,⁴ and its measurement in this study has been based on the components proposed by this author and by further works.^{6–14} Items in our questionnaire could be categorised in three main components: management’s prevention policy (items 1–6), rank and status of safety officers (items 7–8), and company safety practices (items 9–11). Interventions over these components are expected to be related to safety behaviour at work. Zohar concluded from his study that management commitment to safety is a major factor affecting the success of safety programmes in the

Table 3 Risk behaviour and its determinants: number and percentage of workers who “fully” or “highly” agree with safety related statements in three levels of the Safety Climate Index (SCI, summary of answers to specific items for safety climate, items 2–11); pottery industry, Castellon (Spain), 2001 (n = 590)

	SCI <50 (n = 76)		SCI 50–69 (n = 157)		SCI ≥70 (n = 357)	
	n	(%)*	n	(%)*	n	(%)*
I excessively expose myself to risks while working	31	(40.8)	43	(27.4)	75	(21.0)
I have no information for working safely	21	(27.6)	35	(22.3)	29	(8.1)
I have no knowledge of risks in my job place	16	(21.1)	28	(17.8)	30	(8.4)
I lack enough experience for working safely	11	(14.5)	21	(13.4)	21	(5.9)
I do not work safely because nobody asks me to do it	13	(17.1)	31	(19.9)	27	(7.6)
Work pace prevents me from working safely	42	(55.3)	51	(32.5)	46	(12.9)
When there is an emergency I can’t act safely	36	(47.4)	47	(29.9)	57	(16.0)
If I work safely I have less opportunities to extend my contract	17	(22.4)	15	(9.6)	14	(4.0)

*All differences are statistically significant ($p < 0.001$).

Table 4 Odds ratios* (pottery industry, Castellon (Spain), 2001 (n = 590))

	Self-exposure to occupational risks				Lack of compliance with safety rules			
	Full model		Restricted model		Full model		Restricted model	
	ORat	95% CI	p†	95% CI	ORat	95% CI	p†	95% CI
Safety climate indexes								
≥70	1				1			
50-69	1.50	0.93 to 2.41	0.093	0.91 to 2.17	6.95	3.41 to 14.14	<0.001	3.29 to 12.34
<50	2.79	1.60 to 4.88	<0.001	1.52 to 4.34	12.83	5.92 to 27.80	<0.001	5.60 to 23.73
Age								
Continuous (years)	0.98	0.95 to 1.02	0.381	1.00	1.00	0.95 to 1.05	0.928	
Gender								
Women	1				1			
Men	1.17	0.44 to 3.10	0.748		2.41	0.50 to 11.56	0.272	
Education								
>12 years	1				1			
9-12 years	0.74	0.31 to 1.81	0.516		1.53	0.41 to 5.71	0.528	
8 years	0.99	0.44 to 2.21	0.973		0.71	0.20 to 2.47	0.588	
<8 years	0.68	0.30 to 1.57	0.367		1.99	0.57 to 6.88	0.279	
Children in their charge								
Yes	1				1			
No	0.92	0.44 to 2.21	0.732		1.31	0.67 to 2.54	0.425	
Workplace size								
>200 workers	1				1			
51-200 workers	1.04	0.69 to 1.58	0.839		0.94	0.52 to 1.71	0.842	
<50 workers	0.85	0.47 to 1.56	0.606		0.68	0.29 to 1.63	0.391	
Time working								
Continuous (years)	0.98	0.95 to 1.02	0.346		1.00	0.95 to 1.04	0.948	
Job category								
Supervisors	1				1			
Skilled	0.68	0.30 to 1.57	0.370		2.41	0.48 to 12.18	0.288	
Unskilled	0.76	0.37 to 1.53	0.437		1.67	0.36 to 7.84	0.515	
Type of employment								
Temporary	1				1			
Training	0.81	0.46 to 1.43	0.468		1.10	0.46 to 2.59	0.835	
Continuous (0-10)	0.92	0.81 to 1.05	0.215		1.09	0.93 to 1.29	0.277	

*Odds ratios for unsafe behaviour (item 18 in the questionnaire: "I excessively expose myself to risks while working", full/high accord versus low/none accord), and for safety rules fulfilment (item 26 in the questionnaire: "During the last three months, I have fulfilled safety rules doing my job", sometimes/never versus always/almost always).

†Adjusted odds ratio.

‡p values for Wald test.

§Summary of answers to specific items in the questionnaire evaluating safety climate dimension (items 2-11).

¶Variable without statistical significance in the restricted model (log likelihood ratio test >0.10).

industry.⁴ Although it is assumed that molar perceptions of safety climate are shared by employees in a particular work environment, different perceptions at the individual level between employees in the same industrial organisation are likely to be present. It is important to notice that we have not measured safety climate at the companies level, but safety climate as perceived by each individual. Moreover, our results particularly point out that improvement of the components defining safety climate, as much as improving workers' perception of these components, are expected to be positively related to safer behaviour.

In our study, safety climate scores were not related to personal variables such as age, gender, education, or children in their charge. Women showed a slightly worse perception of safety climate in their workplaces than men, but the number of women in our sample was low. However, gender inequalities in occupational health and safety conditions are likely to be present, and this finding deserves further evaluation in a larger sample of women. On the other hand, slightly lower safety climate scores were observed in smaller plants, where working conditions are expected to be worse and occupational prevention programmes less developed than in larger companies. The lack of a difference in safety climate scores between temporary and fixed contract workers is also noticeable: worse employment and working conditions affect temporary workers, but this fact seems not to influence their perception of safety climate. Indeed, data in table 4 suggest that safety climate is mostly determined by companies' features, individual personal and occupational variables having no effect on it. In a study carried out on 1746 healthcare workers,⁹ safety climate was not related to employees' personal features such as gender, age, or education, although an association was observed between safety climate and workers' compliance with universal precautions.

Workers rating low safety climate indices at their workplaces expose themselves to risks at work more frequently (41%) and comply with safety rules with lower frequency (68%) than workers perceiving high safety climates (21% and 96%, respectively). In fact, safety climate index was the only significant determinant of safety behaviour in multivariate models. Self evaluated level of training seems to have little or no influence on safety behaviour at work. Effectiveness of safety training has been scarcely evaluated in the literature,² although it is a common part of occupational health and safety programmes. Workers in our sample seem to be much more influenced by "informal" sources of training (their own experience or other colleagues' support) than by standard actions (courses, newsletter, or experts' advice).

This research has some limitations. As data collection is cross sectional, an influence of workers' intrinsic behaviour towards safety on their report of safety climate cannot be ruled out. Also, although individuals are expected to be nested within plants, our data did not allow an analysis by company, as the name of the plant in which each interviewee was employed was not registered. However, at the time the study was carried out, more than 250 pottery plants were active in Castellon, and our interviewees are expected to be distributed in a large number of companies. Also we were not able to contrast the workers' safety climate perceptions with direct measurement of safety levels at the companies, but other studies provide some data on this issue. Shannon and colleagues⁸ found that strong determinants of safety climate such as demonstration by management of its concern for the workforce or greater worker empowerment (participation in decision making) were associated with lower lost-time accident rates. Similarly, Varonen and Mattila⁷ observed a correlation between accident rates at eight wood processing

companies and organisational responsibility (a dimension similar to what we have called in this study "management's prevention policy") and company safety precautions (similar to our dimension "company safety practices") measured through questionnaires answered by the workers. In a study carried out with hospital workers, it was observed that the perception of senior management's support of safety programmes was the most significant determinant of employees compliance with safe work practices and of frequency of incidents of exposure to blood and other potentially contaminated body fluids.¹⁰

In the analysis of the safety climate index 144 individuals were excluded because of missing data in one or more of the items composing this index (tables 2, 3, and 4). We compared workers with complete data for SCI calculation with workers with missing data for SCI regarding personal and occupational variables, and some significant differences were observed (data not shown). Although safety climate index (SCI) was only related to job category and workplace size (table 2), strictly we cannot generalise our results regarding SCI to the total sample, but only to workers answering all items 2–11.

The relation between safety climate components and safety levels has been observed in other studies. Brown and Holmes¹⁴ explored safety climate measurement in two groups of employees having and having not being involved in accidents at work. They observed clear differences in levels of safety climate perception in both groups, although their observations were cross sectional; as pointed out by these authors, physical trauma may influence a posteriori employees' perception of management concern about safety at work, the temporal relation being uncertain. Company policy towards safety was found to be the main determinant of safety climate in a study carried out on employees of three airport companies.⁵ In this study, the companies with higher safety levels, measured by the frequency of incidents/accidents during the previous 12 months, also had higher scores in the safety climate. However, the researchers discussed the difficulties of properly measuring "safety level" in the companies, a recurrent problem in occupational health and safety evaluation.

It should be noted that data from these previous studies are also cross sectional. Besides validation of workers' report of safety climate levels at their workplace, intervention studies improving safety climate at selected companies and measuring workers' behaviour towards safety before and after the intervention will strongly help to further clarify the relations between safety climate, safety levels, and workers' behaviour regarding safety at work.

This study was focused on the pottery industry in Castellon, a sector with particular features. In fact the pottery industry is a modern industry compared to other industrial sectors in the area. In this context, mean safety climate index could be considered as particularly high (61% of the workers rated SCI ≥ 70), a somewhat surprising finding for a country exhibiting the highest rates of occupational accidents in Europe.¹⁵ Even so, differences for level of occupational risk management and prevention among pottery plants (in Castellon there are near 300 different pottery plants) do exist, and we think that the results of this study should be equally valid for other industries or service companies, a hypothesis to be tested in future research.

In conclusion, this study showed a strong association between workers' perception of organisational factors related to occupational health and workers' behaviour towards safety at work. Although longitudinal studies can further clarify the relation between safety climate and workers' behaviour, management's commitment to safety seems a strong

determinant of success of interventions focused to improve workers' behaviour regarding occupational health and safety.

ACKNOWLEDGEMENTS

This study was carried out with the support of Union de Mutuas (Spanish Occupational Insurance Company No. 267), ASCER (Spanish Pottery Industry Employers' Organisation), and CC.OO (Spanish Labor Union). Financial support was obtained from FORCEM (Spanish Institution for Training and Employment). Rebeca Torada (ISTAS) and Pablo Torrecillas (EMER-GFK) provided valuable advice and assistance during the work.

.....

Authors' affiliations

A M Garcia, University of Valencia, Spain

P Boix, Trade Union Institution of Work, Environment and Health (ISTAS), Valencia, Spain

C Canosa, EMER-GFK, Valencia, Spain

APPENDIX: ITEMS AND ANSWER SCALES IN THE QUESTIONNAIRE ON HEALTH AND SAFETY BEHAVIOUR OF WORKERS' IN THE POTTERY INDUSTRY; CASTELLON (SPAIN), 2001

Safety climate

(level of accord on a numeric scale from 0 to 10)

General item

1. In my company workers' health and safety are sufficiently protected

Specific items

2. Management is seriously involved in occupational risk prevention
3. Productivity and safety at work are equally important
4. My company invests in risk prevention
5. Supervisors encourage safe behaviour
6. Supervisors take into account my opinion and suggestions on health and safety
7. There are persons exclusively devoted to health and safety
8. Persons devoted to health and safety are competent
9. There are explicit rules for safe working
10. I have received adequate health and safety training
11. I have received adequate equipment for personal protection

Workers' health and safety behaviour

(yes/no)

12. Have you ever make to your supervisor suggestions for improving health and safety?
13. Have you ever reported to your supervisor faults or conditions involving a risk for you or other workers?
14. Have you ever asked for personal protection equipment?
15. Have you ever warned other workers about health and safety risks at the workplace?
16. Have you ever asked for information regarding health and safety at your workplace?
17. Have you ever get in contact with your health and safety representative for health and safety problems?

(level of accord, 4-point scale: full/high/low/none)

18. I excessively expose myself to risks while working
19. I have no information for working safely
20. I have no knowledge of risks in my workplace
21. I lack enough experience for working safely

22. I do not work safely because nobody ask me to do it
23. Work pace prevents me from working safely
24. When there is an emergency I can't act safely
25. If I work safely I have less opportunities to extend my job contract

(frequency, 5-point scale: always/almost always/sometimes/almost never/never)

26. During the last three months, I have fulfilled safety rules doing my job
27. Causes for safety rules compliance, select three maximum:
 - It is mandatory by the company
 - The supervisor draws my attention if I do not
 - Lack of compliance with safety rules may involve a sanction
 - Management considers positively this behaviour
 - Other workers consider positively this behaviour
 - It affects positively job promotion
 - I am convinced this is important for my health and safety
28. Causes for lack of compliance with safety rules, select three maximum:
 - They are imposed without discussion
 - They are incompatible with production requirements
 - They make my job more difficult and annoying
 - They are not really useful
 - I do not want to cooperate with the company on this
 - I prefer my own strategies to cope with hazards at work

Health and safety formation/training

29. Self evaluation on a numeric scale from 0 to 10
30. Main contributors to training, select three maximum:
 - Own experience
 - Management's instructions
 - Other workers' support and help
 - Training courses
 - Supervisors' advice
 - Health and safety technicians' advice
 - Safety rules or newsletters

REFERENCES

- 1 **Griffiths A**. Organizational interventions. *Scand J Work Environ Health* 1999;**25**:589–96.
- 2 **Cohen A**, Colligan MJ. Assessing occupational safety and health training. A literature review. Report no. 98-145. Washington: DHHS (NIOSH), 1998. Available from: URL: <http://www.cdc.gov/niosh/98-145.html> (accessed 12 March 2002).
- 3 **Lindell MK**. Motivational and organizational factors affecting implementation of worker safety training. *Occup Med* 1994;**9**:211–40.
- 4 **Zohar D**. Safety climate in industrial organizations: theoretical and applied implications. *J Appl Psychol* 1980;**65**:96–102.
- 5 **Isla Diaz R**, Diaz Cabrera D. Safety climate and attitude as evaluation measures of organizational safety. *Accid Anal Prev* 1997;**29**:643–50.
- 6 **Rundmo T**. Safety climate, attitudes and risk perception in Norsk Hydro. *Safety Science* 2000;**34**:47–59.
- 7 **Varonen U**, Mattila M. The safety climate and its relationship to safety practices, safety of the work environment and occupational accidents in eight wood-processing companies. *Accid Anal Prev* 2000;**32**:761–9.
- 8 **Shannon HS**, Walters V, Lewchuk W, et al. Workplace organizational correlates of lost-time accident rates in manufacturing. *Am J Ind Med* 1996;**29**:258–68.
- 9 **Anderson E**, McGovern PM, Kochevar L, et al. Testing the reliability and validity of a measure of safety climate. *J Health Qual* 2000;**22**:19–24.

- 10 **Gershon RR**, Karkashian CD, Grosch JW, *et al*. Hospital safety climate and its relationship with safe work practices and workplace exposure incidents. *Am J Infect Control* 2000;**28**:211–21.
- 11 **Ley de Prevención de Riesgos Laborales**. L. No. 31 (8 November 1995).
- 12 **García AM**, Benavides FG. Objetivo 25: Mejorar la salud laboral. In: Alvarez-Dardet C, Peiró S, eds. *Informe SESPAS 2000: la salud pública ante los desafíos del nuevo siglo*. Granada: Escuela Andaluza de Salud Pública, 2000:327–36, (in Spanish).
- 13 **StataCorp**. Stata Statistical Software: release 7.0. College Station: Stata Corporation, 2001.
- 14 **Brown RL**, Holmes H. The use of a factor-analytic procedure for assessing the validity of an employee safety climate model. *Accid Anal Prev* 1986;**18**:455–70.
- 15 **Dupré D**. *Accidents at work in the EU 1998–1999*. European Communities 1995–2002, Catalogue number KS-NK-01-016-EN-I. Available from: URL: <http://europa.eu.int/comm/eurostat/> (accessed 7 May 2002).