Impact of health and safety representative training on concepts of accident causation and prevention

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In South Australia, health and safety representatives (HSRs) may undertake three levels of training, commencing at basic level, then progressing through advanced level to continuing level.

A survey of 1,200 HSRs in SA was conducted to assess their beliefs about accident causation and accident prevention.

In regard to accident causation, the survey found that HSRs showed a tendency to favour behavioural causation over workplace environment or systems-type causation. In regard to accident prevention, HSRs at all levels of training had a preference for low-order controls. However, there appears to be some shift in thinking by the time HSRs have completed all levels of training (that is, to the continuing training level), though the thinking of most remains distinctly safe-worker in orientation.

KEYWORDS

- HEALTH AND SAFETY REPRESENTATIVES
- TRAINING
- BELIEFS
- ACCIDENT CAUSATION
- ACCIDENT PREVENTION

Introduction

The research reported in this study was undertaken as part of the *Evaluation of Health and Safety Representative Training in South Australia* conducted by the University of Ballarat on behalf of the WorkCover Corporation of South Australia (WorkCover).[1] The purpose of the study was to provide an independent report on health and safety representative (HSR) training in SA to what was then the South Australian Occupational Health and Safety Commission that was reviewing the system.

In SA, HSRs can undertake three levels of training: (1) basic; (2) advanced; and (3) continuing.

Only training providers that are approved by WorkCover can deliver training. At the time of the research there were three approved providers in SA (an employer body, a union body and a private provider).

The research, undertaken between August and September 1996, involved various methods, including meetings with stakeholders and inspection of training in-progress. However, this article focuses on a selection of data collected by way of a postal survey of HSRs and a similar survey that was conducted on site at the beginning and at the conclusion of three basic level training courses.

Methodology

Postal survey

A postal survey was designed in consultation with WorkCover. A random sample of 1,200 HSRs was selected from the WorkCover database of 8,516 HSRs who were elected between 1 January 1993 and 31 July 1996. Selecting HSRs who were elected prior to January 1993 was considered likely to lead to a greater proportion of lapsed representatives, incorrect addresses, etc. The questionnaires were posted to the subjects' home address to avoid any possible conflict with employers about the survey.

The survey was, in part, designed to obtain basic explanatory information, such as work location and the level of training achieved, and multiple response questions were included about matters such as the quality of training and the level of self-confidence in the role of HSR. The survey was also designed to assess beliefs about accident causation and accident prevention strategies, and it is these areas that are discussed in this article.

Accident causation (question 17 in the survey): subjects responded on a five-point scale (strongly disagree to strongly agree) to indicate the extent to which they agreed that the following eight items caused accidents at their workplace: (1) lack of training in how to behave safely; (2) lack of hazard control planning by management; (3) carelessness of the injured person; (4) unsafe working conditions; (5) accident-prone workers; (6) poor equipment; (7) inexperience of the injured person; and (8) poor layout of workplace.

Accident prevention strategies (questions 18–20 in the survey): subjects were presented with a set of case study-based problems that had been drawn from previous OHS research.[2] The problems consisted of a short description of an accident, followed by a set of six potential solutions (see the Appendix for a description of the problems). For each problem, subjects were required to rank the solutions to indicate what they believed would be the most effective solution through to the least effective. When ranking these solutions, subjects were instructed to put aside practicalities such as cost and concentrate on what would be the most effective if it could be done. This was designed to assess knowledge of the control-at-source and hierarchy of control problem-solving model that underpins Australian OHS legislation. For instance, one of the chief objectives of the SA OHS Act is to "*eliminate, at the source*, risks to the health, safety and welfare of persons at work" (*Occupational Health, Safety and Welfare Act 1986* (SA), section 3(b) (emphasis added)). The *Occupational Health,* *Safety and Welfare Regulations 1995* (SA) follow this model and outline the following hierarchy as a guide to its application:

> "3.3.3(1) One or more of the following must be used to eliminate or, where that is not reasonably practicable, minimise any risk to health or safety:
>
> (a) firstly, the application, so far as is reasonably practicable, of engineering controls, including substitution, isolation, modifications to design and guarding;
>
> (b) secondly, if steps taken under paragraph (a) do not minimise the risk, the application, so far as is reasonably practicable, of administrative controls, including safe work practices;
>
> (c) thirdly, if steps taken under paragraphs (a) and (b) do not minimise the risk, the provision of appropriate personal protective equipment."

The legislation requires that higher order controls (for example, engineering) be implemented where these approaches are *practicable*. Therefore, in an ideal situation (as was proposed in the instructions regarding the ranking of solutions), one would expect subjects who were versed in this model to rank the solutions accordingly. To test the relationship between a subject's response and the ideal model, each response (ranked from 1–6) was correlated with a standard rank based on the hierarchy of control model. This method has been used in previous studies and the standard rank has been shown to correlate well with the judgments of OHS experts.[2,3]

On-site survey

Field visits were conducted to observe training. During these visits, HSRs who were attending basic level training completed the accident prevention strategy problems from the survey (see Appendix) at both the beginning and at the conclusion of the training. An employer group, a union body and a non-aligned provider were visited while HSRs were undertaking training at each level (basic, advanced and continuing) but, due to time constraints, only participants at the basic training level were tested.

Statistical analysis

Accident causation

The primary indicators were eight responses on a five-point scale of agreement/disagreement, one for each of the eight items listed. To explore the relationships between the eight responses, a principal components analysis was carried out on these eight variables. Two rotated principal components were used as composite indicators of safe-workplace and safe-worker attitudes, respectively. To test for differences in attitudes between different subgroups of HSRs, the component scores were used as dependent variables in a number of one-factor analyses of variance.

Accident prevention strategies

The indicators were three Spearman rank order correlation coefficients (one for each of three scenarios) between the subject's rankings of accident prevention strategies and the standard rankings based on the hierarchy of control model. A Spearman correlation coefficient may take values in the −1 to +1 range, and is an indication of the strength of any linear relationship between two sets of rankings. A positive value suggests that the subject's rankings tend to be similar to the standard rankings. A negative value suggests that the subject tends to rank highly those strategies that have a low standard ranking, and vice versa. A value near zero indicates little linear relationship between the two rankings.

The three correlations were used as dependent variables in a number of tests for differences between different subgroups (Mann-Whitney and Kruskal-Wallis tests) and the same subgroups on different occasions (Wilcoxon signed rank tests). Although the sample sizes were large in almost all subgroups considered, non-parametric tests were used because of substantial departures from normality, usually in the form of pronounced positive skew, of the scores within the various subgroups.

Results

General

Of the 1,200 surveys posted, 405 were returned in time for analysis (34%). Of the 405 responses, 374 were valid for use as they were from current HSRs (31% of the total mailout). These 374 responses are referred to as the sample. Most of the sample (80%) had attended at least one HSR training course. Generally, this training had been undertaken since 1993. A breakdown of training levels attained is shown in Table 1.

The statistical inferences reported are predicated on the assumption that the sample surveyed is representative of the whole population of HSRs in SA. However, while the sample was randomly selected and the response rate was quite substantial, there is a possibility that the validity of the conclusions reported might be undermined to some degree by self-selection bias. There may be important differences between the attitudes and beliefs of those who responded and those who did not, and so the sample might not be representative of the population as a whole.

Accident causation

Table 2 shows the set of statements regarding accident causes which were contained in the postal survey. The statements were organised around the themes of safe-worker (statements a, c, e and g), and safe-workplace (statements b, d, f and h). The aim of the statements was to assess whether, in analysing accidents, HSRs tended towards victim blaming and behavioural failure (safe-worker) or workplace and organisational failure (safe-workplace).

Figure 1 shows the responses grouped as "Total disagree" and "Total agree" (the neutral responses are not shown). The eight items are listed in decreasing order of the proportion of Total agree responses. Three out of the four safe-worker causes (carelessness, inexperience and lack of training) are the most popular. The next most popular were the four safe-workplace causes. The least popular cause was accident-prone workers. Although accident proneness seems to be generally rejected, there is a popular acceptance of other causes that seem to be worker-related (that is, carelessness, inexperience and lack of training).

To explore the relationships between the eight responses, a principal components analysis was carried out on these eight variables. The first two principal components, which accounted for 40% and 20% of the variance respectively, were retained, and a varimax rotation was carried out to improve interpretability. Six loadings with magnitudes of less than 0.12 have been disregarded in Table 3, in order to clarify the essential characteristics of each component. All the remaining loadings were positive. The first rotated component (see PC1 in Table 2) had high positive loadings (> 0.70) on all four safe-workplace items, and moderate positive loadings (> 0.30) on two of the four safe-worker items (that is, lack of training and inexperience). Since both of these items also involve some

TABLE 1
Training levels attained

Highest level of training	*Number*	*%*	*Date undertaken*
None	73	20	
Basic	172	46	80% of these 1993–1996 (inclusive)
Advanced	79*	21	80% of these 1993–1996 (inclusive)
Continuing	50*	13	90% of these 1993–1996 (inclusive)
Total	374	100	

* The three levels of training are generally undertaken sequentially. However, six of the 79 respondents with advanced training reported no basic training, and nine of the 50 with continuing training reported basic training but no advanced training.

TABLE 2

Accident causation: principal components and response profiles

Principal component loadings PC1	PC2	Statement "Accidents at my workplace are usually caused by...	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
			Percentage (%) of responses				
*	*	... lack of training in how to behave safely"	7	37	14	31	10
**		... lack of hazard control planning by management"	6	36	22	26	10
	**	... carelessness of the injured person"	4	19	29	42	6
**		... unsafe working conditions"	9	40	25	22	5
	**	... accident-prone workers"	15	38	30	14	3
**		... poor equipment"	8	46	20	21	6
*	*	... inexperience of the injured person"	5	26	27	37	5
**		... poor layout of workplace"	7	31	23	31	8

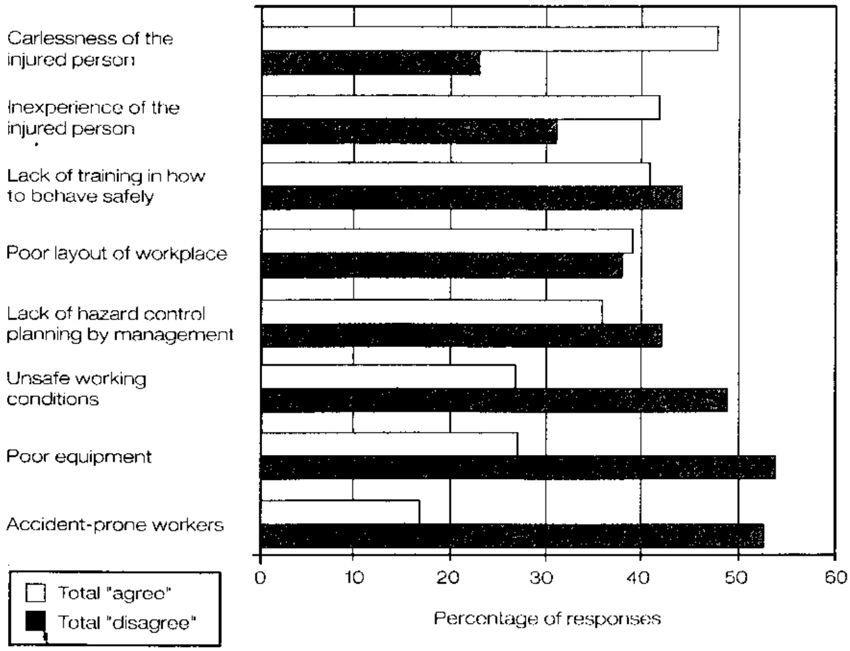
* loading > 0.30 ** loading > 0.70.

employer responsibility, this component can be regarded as a composite indicator of safe-workplace concepts. The second rotated component (see PC2 in Table 2) had high positive loadings (> 0.70) on carelessness and accident-prone workers, and lower positive loadings (> 0.30) on training and inexperience. This component can be regarded as a composite indicator of safe-worker concepts. Scores on both components are standardised, with a mean of zero and a standard deviation of one unit. In each case, a positive score indicates general agreement with the relevant statements about accident causation, that is, acceptance of the concept, and a negative score indicates general disagreement or rejection of the concept. Note that these two components are not opposites of each other — they are statistically independent, which implies that knowledge of an individual's score on one component tells nothing about his/her score on the other component. Individuals may attribute accident causation either to workers or to workplaces or to both, in any combination and to any degree.

To test for differences in attitudes between different subgroups of HSRs, the scores on these two components were used as dependent variables in a number of one-factor analyses of variance. As well as the key explanatory variable — level of training — 10 other explanatory variables were tested: employment sector (government or non-government); industry; size of organisation; number of workers that the HSR represents; period of time spent as an HSR; provider of basic training; formal OHS qualifications; age; gender; and geographical location. Although there was a statistically significant departure from normality in the residuals of some of these analyses, validity of the F-tests was not compromised because the normality tests, being based on over 300 degrees of freedom, were extremely sensitive. Inspection of normality plots showed that the distributions were slightly skewed and/or short-tailed and, furthermore, the sample sizes in most subgroups were large enough to ensure robustness to non-normality.

The analyses of variance of components 1 and 2 by each of the 11 explanatory variables yielded only three results that were statistically significant at the 0.05 level. Mean scores on component 1 differed significantly between genders ($F(1,343) = 4.294$, $p = 0.039$), with females tending to score lower than males ($M_F = -0.15$, $M_M = 0.07$), indicating a comparative reluctance of females to assign causes to

FIGURE 1
Causes of accidents (ordered by "Total agree")



workplace conditions. A similar, though not significant, trend was also present in scores on component 2 (M_F = –0.12, M_M = 0.06, $F(1,343)$ = 2.82, p = 0.094), indicating a tendency for women's assessments of causes of either type to be more cautious than men's. Mean scores on component 2 also differed significantly by length of service ($F(3,344)$ = 2.822, p = 0.039). Health and safety representatives with medium lengths of service tended to score higher on this factor, indicating more alignment with the safe-worker model, while those with short or long periods of service tended to score lower. Mean scores on component 1 differed significantly by employment sector, with non-government employees tending to score higher than government employees (M_G = –0.11, M_{NG} = 0.13, $F(1,342)$ = 5.137, p = 0.024). However, this result must be interpreted cautiously since the variance in the non-government group was also significantly higher than that of the government group (Levene $F(1,342)$ = 8.406, p = 0.004).

It should be noted that because of the large sample sizes, the statistical tests had very high discriminating power. While statistical significance is evidence that the differences in component scores were likely to be due to a real effect present in the population of HSRs rather than a chance result in the sample, the magnitudes of the observed differences are substantively small, that is, we are dealing with relatively slight tendencies. There is a second reason for caution: the multiple comparison effect. When 22 tests are carried out — each at a significance level of 0.05 (1 in 20) — the likelihood of at least one "false positive" result is quite high.

With regard to the effects of training, there was no general tendency towards either a reduction in the safe-worker conceptualisation or an increase in the safe-workplace conceptualisation, with increasing levels of training from none through to basic and advanced. There was, however, a tendency towards both of these changes which was associated with continuing training, though the differences were not statistically significant in either case.

Accident prevention strategies

The three dependent variables analysed were Spearman rank order correlation coefficients between the subject's rankings of accident prevention strategies and the standard rankings based on the hierarchy of control model. The values of each of the three variables were spread across the whole range of possible values from −1 (opposite rankings) to +1 (identical rankings). In each case the distribution was skewed. Negative values predominated, indicating a tendency to favour low-order controls, but there was also a long "tail" extending to the positive end of the scale, representing a minority of HSRs whose views were more aligned with the hierarchy of control model.

To test for differences in risk control concepts between different subgroups of HSRs, Kruskal-Wallis one-factor analyses of variance were carried out, using the same set of 11 explanatory variables discussed above (see Accident causation). Although the sample sizes were large in almost all subgroups considered, the Kruskal-Wallis test was used because of substantial departures from normality of the scores within the various subgroups, usually in the form of pronounced positive skew.

The 33 tests (three dependent variables x 11 explanatory variables) yielded seven results which were statistically significant at the 0.05 level. There were significant differences between industry sectors, with government workers tending to score higher than non-government workers on problem one (that is, the aircraft fitter ($\chi^2(1) = 5.10$, $p = 0.024$)), and on problem two (that is, the gardener ($\chi^2(1) = 3.98$, $p = 0.047$)). Responses to problem two also differed significantly between: (a) industries ($\chi^2(10) = 19.7$, $p = 0.032$), although there was no obvious pattern of differences in this case; and (b) levels of OHS qualifications ($\chi^2(1) = 6.43$, $p = 0.011$), with formally qualified representatives (somewhat surprisingly) tending to score lower than those with no formal qualifications (this was also the case for the other two problems, though not to a statistically significant degree). There were significant age differences in the responses to problem three (that is, the cable laying contractor ($\chi^2(1) = 3.98$, $p = 0.047$)), where the mean score steadily decreased with increasing age (although there was no evidence of such a trend with the other two problems). There were also significant effects associated with training level, which are discussed in a broader context below (as comparison test A).

Again, it should be noted that with 33 tests (each undertaken at the 0.05 level of significance), the probability of false positive conclusions is high. All of the results quoted above are only marginally significant; none is individually significant if a multiple comparison adjustment such as Bonferroni correction is applied.

The three case study problems on accident prevention strategies were presented to two sets of subjects: (1) the mail survey group; and (2) three groups of HSRs (total = 53) who were undertaking basic training in three separate sessions delivered by the State's three accredited providers. The HSRs in these courses completed this part of the survey both before the basic training (during the first morning) and after the basic training (on the last day). As two of the three courses were conducted over five consecutive days, the HSRs in these courses completed the problems on a Monday and then again on Friday of the same week. The third course was conducted as a "split" course, that is, three consecutive days followed by a break of three weeks (during which the HSRs completed workplace-based projects), and then the remaining two consecutive days. Therefore, the second attempt at the problems by these HSRs was three weeks and four days after the first attempt.

The pre- and post-course data were collected prior to the survey. It is probable that a small number from the pre-course/post-course group were also present in the main survey sample. On the basis of the size of the HSR population, the size of the survey sample and the number of HSRs in the pre- and post-course component, this number is estimated at less than three persons (6% of the training sample and 1% of the survey sample). This is considered too small to significantly invalidate the assumption of independent samples in comparison tests C and D below.

Four comparisons were made for each of the three dependent variables, using an appropriate non-parametric test in each case:

— Comparison A: survey group by training level (Kruskal-Wallis test);

— Comparison B: training group before and after basic training (Wilcoxon signed rank test);

— Comparison C: survey group with no training vs training group before basic training (Mann-Whitney test); and

— Comparison D: survey group with basic training vs training group after basic training (Mann-Whitney test).

The results of these comparisons, together with mean and median correlations for each group on each problem, are summarised in Table 3 and Figures 2 and 3. The non-parametric tests, being based on ranks, are essentially tests about medians.

Comparison A shows clear effects associated with training level. In all cases, the largest difference in both mean and median scores was associated with continuing training; the difference was significant at the 0.05 level for problems one and three, and not quite so for problem 2 ($\chi^2(3) = 9.51$, $p = 0.023$; $\chi^2(3) = 7.21$, $p = 0.065$; $\chi^2(3) = 8.86$, $p = 0.032$). Mann-Whitney tests showed that three of the six pairwise differences between "continuing" and "advanced" groups and "continuing" and "basic" groups were significant at the 0.05 level. After post hoc Bonferroni adjustment, none of the pairwise differences was individually significant, although this is a conservative adjustment in the context of categories which are ordered a priori.

Comparison B indicates that the distributions of the post-training scores of the training group were significantly different from those of the pre-training scores for all three problems ($z = 2.326$, $p = 0.020$; $z = 2.606$, $p = 0.009$; $z = 2.793$, $p = 0.005$). In each case, the mean and median post-training score was higher than the mean and median pre-training score, the differences being 0.21, 0.23 and 0.26, respectively, for the means, and 0.08, 0.37 and 0.38 for the medians.

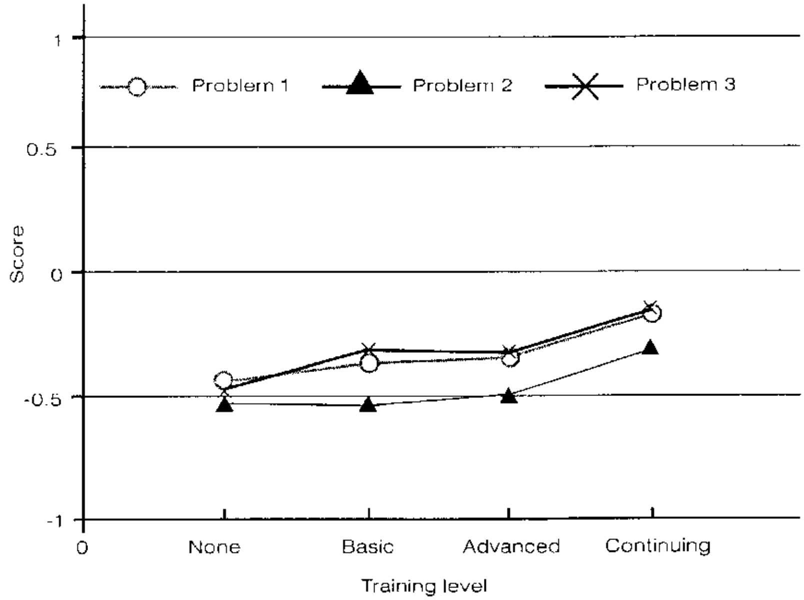
TABLE 3

Risk control concepts: mean scores and statistical comparisons

						Median and mean correlation with standard rank					
						Problem					
		Statistical				*One*		*Two*		*Three*	
Group	*Level of training*	*comparison*				*Mean*	*Median*	*Mean*	*Median*	*Mean*	*Median*
Training	None (pre-basic)		B	C		−0.50	−0.54	−0.57	−0.77	−0.44	−0.52
Training	Basic (post-basic)		B		D	−0.29	−0.46	−0.34	−0.40	−0.18	−0.14
Survey	None	A		C		−0.44	−0.46	−0.53	−0.66	−0.48	−0.60
Survey	Basic	A			D	−0.37	−0.49	−0.53	−0.77	−0.32	−0.43
Survey	Advanced	A				−0.35	−0.43	−0.50	−0.71	−0.33	−0.49
Survey	Continuing	A				−0.18	−0.29	−0.32	−0.37	−0.16	−0.37

	Comparison	One	Two	Three
	A: Kruskal-Wallis	$\chi^2(3) = 9.51$, $p = 0.023$	$\chi^2(3) = 7.21$, $p = 0.065$	$\chi^2(3) = 8.86$, $p = 0.032$
	B: Wilcoxon signed rank	$z = 2.326$, $p = 0.020$	$z = 2.606$, $p = 0.009$	$z = 2.793$, $p = 0.005$
	C: Mann-Whitney	$z = 2.15$, $p = 0.032$	$z = 1.225$, $p = 0.221$	$z = 0.684$, $p = 0.484$
	D: Mann-Whitney	$z = 0.158$, $p = 0.874$	$z = 2.526$, $p = 0.012$	$z = 1.767$, $p = 0.077$

FIGURE 2
Mean score on problems one to three: by highest training level achieved (data from survey)



Comparison C indicates that the distributions of the pre-training scores of the training group and the scores of the no training survey group were significantly different for problem one but not for problems two and three (z = 2.15, p = 0.032; z = 1.225, p = 0.221; z = 0.684, p = 0.484). The pre-training group had lower mean and median scores on problems one and two and higher mean and median scores on problem three, but in each case the differences were small (–0.06, –0.04 and 0.04 for means; –0.08, –0.11 and 0.08 for medians). Inspection of the distributions indicated that the significant difference for problem one related not so much to a difference in average level as it did to a difference in the shape of the two distributions, with the scores of the pre-training group being clustered rather more closely around the centre.

Comparison D indicates that the basic training survey group had lower mean and median scores than the post-training group on all three problems (the differences being 0.08, 0.19 and 0.14 for means and 0.03, 0.37 and 0.29 for medians), although the difference was only significant for problem two and not for problems one and three (z = 0.158, p = 0.874; z = 2.526, p = 0.012; z = 1.767, p = 0.077).

From these results, it can be concluded that:

— HSRs tested prior to basic training were broadly similar to the survey respondents with no training (comparison C);

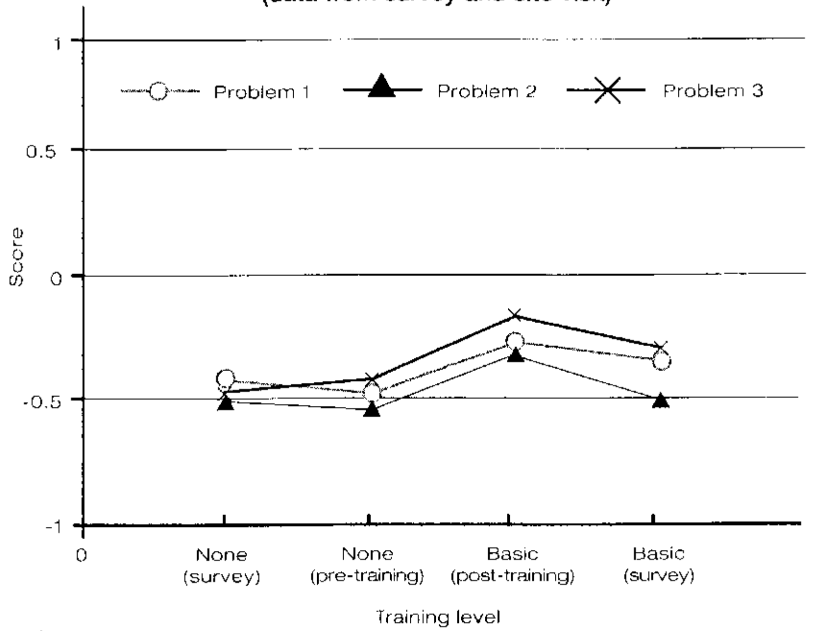
— HSRs tested immediately following basic training had changed their views positively, that is, towards the standard rankings (comparison B);

— there is some indication that HSRs do not retain over a long period all of the improvement noted immediately following basic training (comparison D); and

— the training level reached before there was any long-term effect (as detected in the survey) on HSR thinking is continuing training (comparison A).

With only one exception, the mean correlations are higher than the corresponding median values, which

FIGURE 3
Mean score on problems one to three: by highest training level achieved (data from survey and site visit)



reflects the fact that the score distributions for all problems and all groups were positively skewed. The magnitude of the differences indicates that there was some tendency for the skew to be greater in the trained groups than in the untrained groups. This has two implications. On a technical level, because the mean is sensitive to skew, the magnitude of changes in the mean tend to exaggerate the overall degree of change. Substantively, it also suggests that training might have a differential effect on different individuals. An investigation of why this might be so was not within the scope of the present study.

In comparisons B, C and D reported above, the training group was actually the amalgamation of three separate training groups. The scores of the three separate groups were also analysed comparatively. There were significant differences between the three groups prior to undertaking training, with one group tending to score higher on all three problems than the other two groups. While — with one exception — the mean and median scores of all three groups increased for all three problems, in general, and not surprisingly, the increases were greater when the pre-training scores were lower, so that the differences between the three groups after training were reduced. These differences within the amalgamated training group do not affect the conclusions drawn above. In any multivariate analysis, further structural detail lurks behind any broad bivariate conclusion; in the present study, the survey group could also be further disaggregated on the basis of such variables as training provider.

Discussion

Concepts

The survey responses regarding accident causation showed a tendency for HSRs to favour behavioural causation (for example, carelessness, inexperience and lack of training) over workplace environment or systems-type causation (Figure 1). While in general these results are not encouraging, at least there appears to be a strong rejection of the accident proneness theory.

The HSRs' model of accident causation seemed to be aligned to their perceptions of effective solutions for safety problems. As Figure 2 shows, HSRs at all levels of training had average correlation scores below zero, indicating a preference for low-order controls. However, it is encouraging to note that the group which had completed continuing training stands out from those with no training or basic or advanced training. A similar tendency was noted with respect to concepts of accident causation. These results indicate that the safe-workplace model of thinking is most strongly evident in those subjects who have completed all levels of training (that is, basic, advanced and continuing).

These findings, both in terms of causation and in terms of perception of effective controls, are similar to the results obtained by Biggins and Phillips and Gaines and Biggins.[4,5] Both the 1991 and 1992 reports of HSR surveys (125 workers undertaking OHS training in Queensland, and 82 workers undertaking OHS training in the Northern Territory, respectively) showed that the careless worker way of thinking was popular among HSRs, with approximately 46% believing that worker carelessness was the main cause of accidents. An earlier evaluation of HSR training by Cowley and Else found similar views.[6]

Three recent surveys undertaken on behalf of the National Occupational Health and Safety Commission (NOHSC) have shown that the way of thinking demonstrated among HSRs is common in the general working community. The surveys were conducted by ANOP Research Services Pty Ltd and consisted of: telephone surveys of 2,000 people in 1995;[7] a re-survey in 1996 of 502 of the original sample of 2,000;[8] and the most recent survey that consisted of 2,510 "new" subjects.[9] When asked to nominate the main cause of accidents, in each of the three studies about 50% of each sample of working-age people across Australia nominated lack of training or education or worker carelessness.

It seems common for HSRs to assign the blame for accidents to the victims of those accidents. Despite training (as per statutory requirements), HSRs seem to have models of causation which are in line with those of workers in general. As such, the model of prevention held by HSRs is distinctly in line with the safe-worker model. Even given ideal circumstances, HSRs choose behavioural solutions over more systems-orientated/engineering solutions.

Immediate effect of training

The data collected on-site showed that HSRs were more likely to select OHS solutions which were higher up on the hierarchy of control immediately at the conclusion of the training than they were at the beginning of the course (see statistical comparison B and Figure 3). These HSRs began their training with a reverse perception of effective controls for OHS problems than the hierarchy of control would suggest, and the training shifted this perception in a positive way. While the average scores were still negative after the training, it must be noted that the training was only five days in duration and that the hazard management module (which would be most likely to influence this type of thinking) was approximately one day of the training.

The data from immediately prior to the basic training show that these HSRs held similar accident prevention concepts to those of the untrained HSRs who responded to the survey (see statistical comparison C and Figure 3). From the survey data, it was noted that there was no significant difference between the untrained HSRs and the HSRs who had completed basic training (see statistical comparison A and Figure 2), which is in contrast to the immediate effect noted in the pre- and post-course comparison. This suggests that the effect of training diminishes over time. A direct comparison between the HSRs tested immediately after basic training and the previously basic-trained HSRs (see statistical comparison D and Figure 3) showed that the latter group had lower average scores on all three problems, although the difference was only statistically significant for one problem. Therefore, there was some support for the suggestion that the effect of training diminishes over time, but this was not demonstrated conclusively.

Because this was an observational study, it is not conclusive that the better responses of those who had completed continuing training were as a result of the training. An alternative explanation is self-selection, whereby those with more advanced or informed attitudes to OHS might be more likely to proceed to continuing training.

Conclusion

The data collected in this research show that the majority of surveyed HSRs in SA hold a victim-blaming view of causation. These beliefs are similar to those of HSRs in other parts of Australia (as shown by the surveys in Queensland and the Northern Territory).[4,5] Further, these beliefs conform to those of the general working population (as shown by the recent telephone surveys conducted on behalf of NOHSC).[7-9]

The beliefs about causation seem to flow into the HSRs' understanding of effective solutions to OHS problems. Health and safety representatives favour safe-worker solutions over safe-workplace solutions. Their model of prevention falls very much towards the low end of the hierarchy of control. Quite clearly, high-order controls (such as elimination of the hazard or engineering controls) are only required by law when practicability permits such solutions. However, it seems that even when HSRs are given instructions to ignore practical barriers such as cost, they remain locked into the importance of behavioural controls.

An immediate improvement in the way that HSRs judge effective solutions to safety problems was observed following basic training. However, the survey results suggest that this effect diminishes over time, with there being no difference between the responses of untrained HSRs and those who have attended basic or even advanced training. There appears to be some shift in thinking by the time HSRs have completed all levels of training (that is, continuing training), although the thinking of most HSRs remains distinctly safe-worker in orientation.

It is vital that HSRs have a clear understanding of accident causation. More importantly, they should have a clear understanding of the control-at-source and hierarchy of control models if they are to be influential and participate in the development and implementation of good OHS practice. In small business — where HSRs may be one of the few sources of OHS knowledge — clear understanding is especially important.

Those involved in the training of HSRs should be aware of the views that trainees are likely to hold about accident causation and prevention. Training should accordingly give weight to establishing a contemporary view of accidents and their prevention among trainees.

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APPENDIX
Case study problems

Problem one

Aircraft fitters inspect aircraft before each flight. To gain access for inspection, Jim (an aircraft fitter) stood on a tug. A tug is a flat-topped vehicle designed for towing aircraft, luggage trailers, etc. Jim was able to stand on the tug, inspect the aircraft and drive around underneath the aircraft by operating the controls away from the driver's seat.

Jim was moving the tug to a new inspection point when he collided with the aircraft. The collision trapped Jim between the tug and the aircraft fuselage. Jim received multiple fractures to his upper body. Company rules insist that tugs are operated only if the driver is seated in the driver's seat.

Options (standard rank in parenthesis):

a. Reduce the height of aircraft landing gear (1)

b. Institute an employee incentive scheme promoting safe practices (6)

c. Provide a special motorised maintenance trolley (3)

d. Provide training to the fitters in safe equipment use (4)

e. Increase aircraft component reliability (2)

f. Increase supervision to ensure compliance with safety rules (5)

Problem two

Kelly is a gardener at a metropolitan hospital. Kelly was cleaning a "gang" mower when she cut her foot. Kelly had seen other gardeners clean the mower by hosing the blades with water while operating them in reverse. Kelly was washing the mower in this way when her left foot touched the moving blades. The blades left deep cuts in her big toe and two adjacent toes.

There had been no verbal or written instruction about how to wash the mower safely. The hospital provides safety boots but Kelly was not wearing them at the time of the accident. Often outdoor workers wear their own shoes, claiming that they are more comfortable. The hospital has now developed a code of practice for the safe operation of the gang mowers.

Options (standard rank in parenthesis):

a. Provide training in the new code of practice (4)

b. Remind all outdoor staff to wear safety boots (5)

c. Use sheep to graze the grass (1)

d. Purchase a self-cleaning mower (2)

e. Re-sow the grass with a slower growing native variety (3)

f. Provide training away from the workplace in hazard recognition and reporting (6)

Problem three

Percy was a supervisor in a team installing cable to remote areas for a new pay television service. Percy broke bones in both legs during an accident while attempting to un-bog a vehicle.

A two-wheel drive utility carrying generating equipment became bogged. Percy decided to pull the utility out using a much larger four-wheel drive vehicle which was mounted with a cable-laying machine. Percy asked Bill and Ben, two machinery operators, to each drive one of the vehicles while he gave directions. They connected a chain between the front bumper bars of the vehicles. The larger vehicle began reversing and the chain tightened. The bumper bar of the bogged utility then broke loose and struck Percy in the legs.

Options (standard rank in parenthesis):

a. Avoid standing near operations such as this because chains under high tension are prone to unpredictable behaviour (6)

b. Build vehicles with towing hooks at the front and rear (3)

c. Train employees in emergency towing and appropriate ways to connect to the chassis of vehicles (4)

d. Install pay television as a satellite-based system (1)

e. Supply all vehicles as four-wheel drive for off-road use (2)

f. Increase supervisor training in towing hazards (5)

Note: the above problems numbered one to three relate to questions 18–20 in the survey.