COVER SHEET

Analysis of a Safety Climate Measure for Occupational Vehicle Drivers and Implications for Safer Workplaces

Andrew R. Wills, Herbert C. Biggs, & Barry Watson

Centre for Accident Research and Road Safety – Queensland, School of Psychology and Counselling, Queensland University of Technology, Queensland, Australia

Address for correspondence: Andrew Wills, Centre for Accident Research and Road Safety – Queensland, School of Psychology and Counselling, QUT, Beams Rd, Carseldine, Qld 4034, Australia. E-mail: a.wills@qut.edu.au

Abstract

Safety climate, defined as workers' shared perceptions about the importance of safety to their organisation, has received increasing attention as a construct that is useful for benchmarking organisational safety and as a way of measuring the socio-organisational antecedents of safety performance. Few studies have utilised pre-existing safety climate measures and as a result of this, there is limited information about the generalisability of the construct and its underlying dimensions across organisations and industries. This is an important step towards establishing safety climate as a generic organisational construct which can be reliably measured. In those few cases where studies have used existing measures, results indicate inconsistencies in the underlying factor structures. Accordingly, using a sample of 321 employees from three separate organisations and industries, this study examined the factor structure of a modified version of an existing measure (the Safety Climate Questionnaire [SCQ]). Principal components factor analysis revealed that the original factor structure was upheld by the current sample (with the exception of two factors collapsing into one). This provides support for the generic nature of safety climate as it is operationalised by the SCQ. Additional items were included and emerged as two dimensions, providing support for the generalisability of these new factors across the organisations and industries employed. The results are of theoretical and practical significance as they provide evidence for the generic structure of the construct across organisations and industries, and exemplify how a measure of safety climate could be usefully employed in disability management planning and early intervention strategies.

Analysis of a Safety Climate Measure for Occupational Vehicle Drivers and Implications for Safer Workplaces

Organisational climate is defined as employees' shared perceptions about organisational practices, the importance of these practices, and how these practices are managed (Denison, 1996; Reichers & Schneider, 1990). Organisations have been described as having multiple climates and research has identified several sub-climates of interest such as service climate (Schneider, White, & Paul, 1998) and climate for initiative and innovation (Baer & Frese, 2002). Safety climate has also been conceptualised as existing within the broader organisational climate, suggesting that it represents an organisational sub-climate characterised by employees' perceptions of the organisation's safety culture and practices (Hayes, Bartle, & Major, 2002; Neal, Griffin, & Hart, 2000). Based upon these perceptions, it has been proposed that employees make decisions regarding the accepted level of safety required of their own occupational behaviour (DeJoy, 1994; Varonen & Mattila, 2000; Zohar, 1980).

Why is safety climate of concern to behavioural scientists and rehabilitation practitioners? Research has found links between safety climate and the level of safety of employees' behaviours (Cooper & Phillips, 2004; Griffin & Neal, 2000). There is also some evidence supporting the link between safety climate and organisational safety outcomes such as: company accident rates (Diaz & Cabrera, 1997; Varonen & Mattila, 2000); self-reported occupational accident involvement frequency (Mearns, Flin, Gordon, & Fleming, 1998; Mearns, Whitaker, & Flin, 2003); self-reported occupational injury frequency and severity (Gillen, Baltz, Gassel, Kirsch, & Vaccaro, 2002; Vredenburgh, 2002); and the frequency of workers' compensation claims (O'Toole, 2002).

Although there is not one established definition, there has been relative consistency within the available literature in defining safety climate as a construct which represents

employees' shared perception about the importance of safety to their organisation. In terms of experimental operationalisations of the concept, survey instruments have been developed to collect quantitative indications of safety climate as it exists across organisations and workgroups. A review (Flin, Mearns, O'Connor, & Bryden, 2000) found that several underlying dimensions were recurrent across 18 safety climate surveys including perceptions relating to: management behaviours and attitudes; safety management systems such as policies and procedures; risks; work pressures; and competency. Evidence suggests that perceptions concerning management commitment to safety may also be a stable element of safety climate (Cox & Flin, 1998; Farrington-Darby, Pickup, & Wilson, 2005; Guldenmund, 2000; Oliver, Cheyne, Tomás , & Cox, 2002; O'Toole, 2002; Zohar, 1980).

It is important to note that one limitation of the research is that these existing safety climate measures have rarely been used across different organisations and industrial settings, which questions the generalisability of existing measures to industries and organisations outside of those used in the research. Although limited, the evidence suggests that where existing measures have been examined, they have demonstrated a lack of reliability in terms of factor structures (Brown & Holmes, 1986; Niskanen, 1994). While there will be subtle and substantial differences between organisations and industries, there is a need to devise a measure of safety climate that is generic in nature, thus facilitating the ability to measure the construct appropriately and accurately. This is particularly germane in proactive rehabilitation and disability management, as the evidence previously cited suggests linkages between organisational safety climate and organisational safety and accident outcomes. The development of a generic and robust measure of safety climate could provide an early mapping of areas where organisational improvements should be made to enhance safety and consequently reduce the risk of injury and accidents. Such a measure could usefully be employed in combination with other active strategies, such as the involvement of

rehabilitation practitioners in on-site disability management programs and early intervention exemplars.

Study aims

The overall aim of this study was to examine the factor structure of an existing survey measure of safety climate, using a sample of employees from mixed industries and organisations. In doing so, this study focussed upon 'driver' safety climate; the safety climate of employees involved in driving a motor vehicle during the course of their work. This area of interest has been referred to as 'fleet safety' and has been recognised as an important issue for the organisational sciences and Workplace Health and Safety (Haworth, Tingvall, & Kowadlo, 2000; Wills, Watson, & Biggs, 2004).

Glendon and Litherland (2001) created the Safety Climate Questionnaire (SCQ) which they argued included those factors that would be expected to be generic socio-organisational influences upon safety, and should therefore be applicable to most work settings and organisations. They claim that with contextually specific modifications the SCQ should provide a tool that is useful for benchmarking and comparing organisations and industries. The SCQ contains the following six factors: communication and support; adequacy of procedures; work pressure; personal protective equipment; relationships; and safety rules. Glendon and Litherland (2001) argued that the factors included in their survey were 'base level' or 'generic' indicators of safety climate, suggesting that the inclusion of 'higher order', more global dimensions such as management commitment would limit the generalisability of the survey to different organisations and industries. However, management commitment has consistently arisen as a strong component of safety climate in previous research and was expected to be pertinent to the context of interest. As such, the current investigation included management commitment items. Additionally, the SCQ includes only one item relating to training. While the evidence regarding the effectiveness of driver training

is mixed (Watson et al., 1996), it is one of the fundamental countermeasures that organisations use to address employee driver safety. Therefore, employees' perceptions about driver training were considered to be an important aspect of safety climate for drivers and items were also included to represent this. The present research endeavoured to address the following aims using a sample of occupational vehicle drivers from difference industries and organisations: a) examine the factor structure and generalisability of the SCQ to a sample of occupational vehicle drivers from various Australian industries and organisations, and; b) examine whether the addition of items relating to 'management commitment' and 'driver training' would represent additional safety climate factors that would generalise to organisations and industries.

Method

Participants

A total of 329 employees from three organisations based in Queensland, Australia, agreed to participate in the study. Due to missing responses eight participants were removed from the sample prior to data analysis, leaving a total sample of 321 employees. All participants reported driving a motor vehicle at least once during the course of their average working week. The organisations were a local government council, a state government transport agency, and a private industrial company. In order to maximise participant anonymity, demographic information was collected using aggregated scales. The age and gender distributions of each organisation and the total sample are shown in Table 1. The majority of participants were male and were between 40-49 years of age. Although there were few female participants, this gender distribution reflected the nature of the industries and organisations involved. Both males and females were therefore included to ensure the sample was representative of the populations of drivers in these organisations.

Table 1. Sample demographic characteristics

Variable	Organisation			
	A (n = 70)	B (n = 163)	C (n = 88)	Total (N = 321)
Response rate	36%	33%	30%	33%
Gender				
Male	84.3%	98.8%	90.9%	93.5%
Female	15.7%	1.2%	9.1%	6.5%
Age (years)				
17-24	8.6%	1.2%	1.1%	2.8%
25-29	14.3%	4.3%	5.7%	6.9%
30-39	20.0%	21.5%	23.9%	21.8%
40-49	32.9%	49.1%	40.9%	43.3%
50-59	22.9%	21.5%	27.3%	23.4%
≥ 60	1.4%	2.5%	1.1%	1.9%

Procedure

Ethics approval was granted prior to commencement of this study by the QUT Human Research Ethics Committee. Workers (a total of 1000) were contacted through the internal mail systems of the organisations and asked to participate in a voluntary study about organisational safety and driving. They received an information sheet detailing the anonymous nature of the study and management support for their participation; instructions for completing and returning the survey; and the survey. Surveys were returned directly to the researchers in prepaid envelopes. Two weeks following distribution of surveys each organisation was requested to send reminders about participation in the study via email or other internal processes.

Measure

The SCQ. The original Safety Climate Questionnaire (SCQ) was a 58 item survey with 10 underlying factors accounting for 67% of the variance explained (Glendon, Stanton, & Harrison, 1994). The SCQ was developed from a comprehensive process designed to identify the organisational factors which influenced the task performance safety of engineers. Further work by Glendon and Litherland (2001) developed a briefer (32 item) 'generic' version. Items are rated along a nine-point scale with the anchors 'Never', 'Sometimes', and

'Always' at points 1, 5, and 9. As seen in the Appendix, the modified SCQ has been shown to have six factors accounting for 69.3% of the total variance explained. Reliability coefficients for the factors ranged from .72 to .93.

For the current investigation, some modifications were made to the 32-item scale to maintain applicability in the organisations surveyed. These modifications involved removing several items that were not considered to be applicable to the context of interest (see items 1-7 in Table 2). As the specific domain of interest to this study was driver safety climate, a number of items were modified so as to refer specifically to those policies, procedures, and practices that relate to driver and motor vehicle safety. Additionally, several items were added to assess employee perceptions about 'management commitment' to driver and motor vehicle safety (items 8-11) and 'driver training' within the organisation (items 12-13) (see Table 2). Discussion with organisational stakeholders also led to the inclusion of items 14 and 15 below. These changes resulted in a 35-item scale. Finally, to minimise ambiguity for participants when responding, the rating scale was reduced from nine-points to five-points (with the anchors 'Never', 'Sometimes', and 'Always' at points 1, 3, and 5).

Table 2. SCQ items removed and items added for this study

SCQ items removed
1. Arrangements are made so that workers are not working by themselves (Communication and support)
2. Work procedures are technically accurate (Adequacy of procedures)
3. Work procedures are clearly written (Adequacy of procedures)
4. PPE use is monitored to identify problem areas (Personal Protective Equipment)
5. PPE users are consulted for suggested design improvements (Personal Protective Equipment)
6. Findings from PPE monitoring are acted upon (Personal Protective Equipment)
7. PPE use is enforced (Personal Protective Equipment)
Items added
8. Management are committed to driver safety
9. Management are committed to motor vehicle safety
10. Driver safety is central to management's values and philosophies
11. Driver safety is seen as an important part of fleet management in this organisation
12. Motor vehicle training is carried out by people with relevant experience
13. Driver training is provided on skills specific to the type of vehicle driver for work
14. Employees are consulted for suggested vehicle/driver safety improvements
15. Changes in workload, which have been made at short notice, can be dealt with in a way that does not affect driver safety

NB. The SCQ factor loaded is shown in parentheses.

Results

Factor Structure

As modifications and additions were made to the Safety Climate Questionnaire in order to adapt it to the context of work-related driving, an exploratory factor analysis was undertaken to investigate the underlying dimensions of the Safety Climate Questionnaire – Modified for Drivers (SCQ-MD). Factor analysis was performed on the 35 items from 321 cases. This case to variable ratio (10:1) exceeded that recommended by Hair, Anderson, Tatham, and Black (1998). Using Principal Axis Factor Analysis with varimax rotation, Kaiser's criterion of eigenvalues > 1, and Catell's scree test, six factors with loading greater than .30 were extracted, cumulatively accounting for 60.5% of the total variance. The resulting factor loadings of greater than .30 are shown in Table 3.

As shown by the factor loadings (Table 3), the four items included from Glendon and Litherland's 'adequacy of procedures' factor loaded onto Factor 1, with those items from the 'communication and support' factor from the SCQ (items 5, 6, 8, and 11) explaining 39.3% of the total variance. Inspection of the 'adequacy of procedure' items showed that while they refer to safety procedures, three of four specifically refer to the way in which these procedures are communicated to employees, which may provide some explanation for this outcome. As such, Factor 1 was labelled 'communication and procedures'. The remaining SCQ items formed a factor structure which reflected that of the original scale, loading onto factors almost identical to the SCQ. As such, these were labelled as the 'work pressure', 'relationships', and 'safety rules' factors and explained 7.7%, 3.5%, and 1.8% of the total variance respectively. The resulting factor structure provided partial support for the generalisability of the original factor structure of the SCQ to samples from other organisations and industries. Additionally, the new items designed for this study relating to management commitment loaded onto a new factor with acceptable factor loadings,

explaining 5.2% of the total variance. The training items also loaded onto a new factor explaining 3.0% of the total variance (along with the only item from the SCQ referring to training, which loaded on the 'communication and support' factor in Glendon and Litherland's study). These new factors were labelled 'management commitment' and 'driver training' respectively.

Internal consistency of the SCQ-MD factors were examined by calculating Cronbach's alpha reliability coefficients. As shown in Table 3, the factors exhibited excellent internal consistencies. All factors had Alpha coefficients > .8 except for the 'safety rules' items which was moderately stable (.68).

Table 3. Factor loadings for study survey and variance explained (SCQ-MD)

Label and items	1	2	3	4	5	6
Factor 1- Communication and Procedures						
1. Changes in working procedures and their effects on safety are effectively communicated to workers	**.71**					
2. Employees are consulted when changes to driver safety practices are suggested	**.65**					
3. Employees are told when changes are made to the working environment such as the vehicle, maintenance or garaging procedures	**.64**					
4. Safety policies relating to the use of motor vehicles are effectively communicated to workers	**.64**					.30
5. Safety procedures relating to the use of motor vehicles are complete and comprehensive [1]	**.61**		.32			
6. An effective documentation management system ensures the availability of safety procedures relating to the use of motor vehicles [1]	**.59**					
7. Safety problems are openly discussed between employees and managers/supervisors	**.58**	.31				
8. Safety procedures relating to the use of motor vehicles match the way tasks are done in practice [1]	**.54**					
9. Employees can discuss important driver safety policy issues	**.52**					
10. Employees are consulted for suggested vehicle/driver safety improvements	**.48**	.32				
11. Employees can easily identify the relevant procedure for each job [1]	**.47**					
12. Employees can express views about safety problems	**.41**					.33
13. Employees are encouraged to support and look out for each other	**.39**	.35				
Factor 2 – Work Pressure						
14. Time schedules for completing work projects are realistic		**.80**				
15. There is sufficient 'thinking time' to enable employees to plan and carry out their work to an adequate standard		**.77**				
16. Workload is reasonably balanced		**.76**				
17. There are enough employees/drivers to carry out the required work		**.69**				
18. Changes in workload, which have been made at short notice, can be dealt with in a way that does not affect driver safety		**.67**				
19. When driving employees have enough time to carry out their tasks		**.66**				
20. Problems that arise outside of employees' control can be dealt with in a way that does not affect driver safety	.32	**.60**				
Factor 3 – Management Commitment (new factor)						
21. Management are committed to driver safety			**.80**			
22. Management are committed to motor vehicle safety	.36		**.77**			
23. Driver safety is central to management's values and philosophies	.35		**.71**			
24. Driver safety is seen as an important part of fleet management in this organisation	.37		**.67**			
Factor 4 – Relationships						
25. Good working relationships exist in this organisation				**.75**		
26. Employees are confident about their future with the organisation				**.74**		
27. Morale is good		.32		**.69**		
28. Employees trust management				**.57**		
29. Management trust employees				**.57**		
Factor 5 – Driver Training (new factor)						
30. Potential risks and consequences are identified in driver training					**.89**	
31. Driver training is provided on skills specific to the type of vehicle driven for work					**.83**	
32. Motor vehicle training is carried out by people with relevant experience					**.82**	
Factor 6 – Safety Rules						
33. Safety rules relating to the use of motor vehicles can be followed without conflicting with work practices						**.55**
34. Safety rules relating to the use of motor vehicles are followed when a job is rushed						**.47**
35. Safety rules relating to the use of motor vehicles are always practical						**.44**
Percentage of variance explained (%)	39.3	7.7	5.2	3.5	3.0	1.8
Alpha reliability coefficient	.92	.92	.93	.88	.92	.68

[1] Items loaded on 'Adequacy of Procedures' factor in Glendon and Litherland's (2001) study.
NB. Items are listed in descending order of factor loading; factor loadings ≥ .30 are shown.

Organisational differences

Each organisation's mean score and standard deviation for each safety climate (SC) factor are shown in Table 4. A series of one-way analysis-of-variance (ANOVA) tests were conducted to examine the average differences between the three organisations on each of the six SC factors. Five of the six SC factors differed significantly (excluding the 'relationships' factor). Follow-up tests were conducted to evaluate the pairwise differences between organisations. Post hoc comparisons using the Scheffe test (which assumes equal variances) were conducted on all factors except for 'driving training' which was investigated using the Dunnett T test (due to a violation of the homogeneity assumption). Post hoc comparisons revealed that organisations B and C differed significantly on the 'communication' factor (p = .02) and the 'management commitment' factor (p = .04). On 'work pressures', organisations A and B (p = .00), A and C (p = .00) differed significantly. On the 'safety rules' factor, organisations A and B (p = .00), B and C (p = .00) differed significantly. Finally on 'driver training', organisations A and B (p = .00), A and C (p = .00) differed significantly. It is also important to note that there was acceptable variation within each organisation's safety climate dimensions (as seen by inspection of Table 4).

Table 4. Organisational Safety Climate Scores

Organisation	Communication & Procedures	Work Pressure	Management Commitment	Relationships	Driver Training	Safety Rules
Org A (N = 70)	3.84 (.74)	2.99 (.77)	4.09 (.91)	3.05 (.86)	4.15 (.93)	3.94 (.66)
Org B (N = 164)	4.01 (.66)	3.73 (.72)	4.20 (.78)	3.11 (.83)	2.99 (1.30)	4.32 (.55)
Org C (N = 89)	3.78 (.66)	3.53 (.66)	3.91 (.94)	3.16 (.80)	2.83 (1.19)	4.03 (.70)
F	3.76	26.55	3.33	.34	29.02	11.80
p	.02	.00	.04	.71	.00	.00

NB. Standard deviations are shown in parentheses. Scores were calculated to be in the direction of 'safety', i.e. a more positive score indicates safer perceptions (such as less 'work pressure' or stronger 'management commitment').

Discussion

The results partly confirmed the factor structure of the SCQ as a 'generic' survey for assessing safety climate across organisations and industrial settings by showing strong similarities to the structure reported by Glendon and Litherland (2001). There were two major differences in the structural properties of the SCQ items used in the current investigation. The 'adequacy of procedures' items were subsumed within the 'communication and support' factor in this study; although this was not surprising given that these items concerned the organisational communication of procedures. Secondly, the 'communication and support' dimension accounted for the majority of the variance explained by the six safety climate factors (39.3% of total 60.5%). Glendon and Litherland also reported this as the strongest factor (18.3% of total 69.3%), though it was less robust in their study as three of the remaining five items explained between 10% and 13% of the total variance respectively. Although this may be attributed to the loadings of additional items in this study (the four 'adequacy of procedures' items), it is unlikely that these would account for this additional variance given their individual factor loadings ranged from .47 to .61. The new items pertaining to 'management commitment' and 'safety training' loaded on factors (labelled accordingly) and demonstrated excellent internal consistencies.

Safety climate dimensions and structure

The results provide support for Glendon and Litherland's argument that some safety climate dimensions are stable across organisations from different industries and with differing cultures. However, they also question the generic nature of the 'adequacy of procedures' dimension. Although, it is important to note that not all of the SCQ items which loaded on this factor were included in the current study. The necessity of making such modifications to maintain contextual applicability was also noted by Glendon and Litherland. They also argued that the factors included in their survey were 'base level' or 'generic'

indicators of safety climate, suggesting that the inclusion of global dimensions such as management commitment would limit the generalisability of the survey. This study included items on one such dimension – management commitment to safety. This dimension has continually appeared as a strong element of safety climate in previous research and was also deemed to be pertinent to the context of interest. These items formed a strong and stable safety climate factor which held reliably across the three organisations and industries included. 'Management commitment' may therefore be an important aspect of what forms the generic safety climate construct. An additional 'base level' factor was also included – 'safety training'. Although these items were targeted specifically at management commitment to driver and vehicle safety as well as driver training, minimal modifications are required to adapt these items towards general management commitment to employee safety (or Workplace Health and Safety) and general safety related training. These items could also be targeted upon the specific behaviours or contexts of interest (as many of the items pertaining to communication, procedures, and rules were for this study).

Organisational differences were reported to examine the sensitivity of safety climate to organisational differences in culture and practices. The results showed that there were significant differences between organisations in five of the six safety climate factors included (excluding 'relationships'). These differences in various dimensions of safety climate provide support for the utility of the SCQ (and the modified version used here – the SCQ-MD) as a measure that is indicative of the culture for safety within organisations. However, the results relating to the 'relationships' factor may suggest that more extensive research is needed to examine the relative importance and indeed the applicability of this dimension to safety climate measures. This may also question the applicability of the dimension to the conceptual notions of safety climate and culture.

Limitations and future directions

One limitation regarding the 'driver training' dimension (as it was operationalised in this study) is that the items focused on the perceived quality and relevance of any driver training received. Thus a low score on this dimension may indicate that employees had simply not received any driver training. Anecdotal evidence from an open-ended section of the questionnaire provided some support for this interpretation. As this is a difficult issue to control in multiple-organisation research, future studies may address this by: 1) devising items that are organisation/contextually specific; or for the purpose of comparing organisations 2) remove the training dimension and simply determine whether or not training had been offered to employees at all.

This study is subject to the limitations found in research utilising self-reported survey data, and all results should be interpreted with consideration for this limitation. Additionally, due to the statistical limitations attributed to small sample sizes, this study grouped employees from three different organisations and industries into one total sample. Although this extends the generalisability of the measure to multiple organisations and industrial settings, one alternative method is to compare the structure and reliability of the survey results from each organisation (requiring a larger sample from each of the groups involved). Finally, as it was mandatory to protect participant anonymity and confidentiality, the information collected regarding workers' demographical and employment information (such as job types) was limited. In spite of these methodological limitations, the results provide valuable information of practical and theoretical relevance to researchers and practitioners of industrial and organisational psychology.

Future research is required to further examine the utility and reliability of safety climate surveys, and of the construct as an indicator of organisational safety. Larger samples from diverse organisations and industries are needed to adequately compare the underlying

structure of the construct as it exists within and between organisations, work groups, industry sectors, cultures, and even legislative jurisdictions (such as states and countries). Studies should also consider using more stringent statistical techniques such as confirmatory factor analysis where appropriate, and hierarchical factor analysis to statistically confirm the presence of a hierarchical underlying factor structure. In addition, while this study investigated organisational differences in safety climate, future research may further explore the sensitivity of safety climate factors by examining differences at deeper levels within organisations, such as departments or divisions, work groups and teams, and work locations. Such analyses will reveal richer and contextually relevant information about employees' experiences of organisational safety culture at various levels within the organisation.

Conclusions

The generalisability and reliability of the Safety Climate Questionnaire (SCQ) was examined and confirmed using a version of the survey modified for work-related motor vehicle drivers (the Safety Climate Questionnaire – Modified for Drivers [SCQ-MD]). This study also provided evidence suggesting that the inclusion of 'management commitment' and 'safety training' factors may provide additional information about an organisation's safety climate. The results are of theoretical and practical significance. They provide evidence for the stable structure of the shared safety climate of workers across organisations and industries, supporting its conceptualisation as a generic organisational construct. The findings also exemplify that a measure of safety climate can be sufficiently modified by researchers and practitioners to reflect the nature of the organisation and context of interest. When conducting research on or assessing organisational safety, these results should be considered before using or modifying safety climate measures. The results make substantial contributions to the knowledge available concerning the conceptualisation and measurement of the socio-organisational antecedents to organisational safety performance, and have a

direct and immediate usefulness to rehabilitation and disability management as a planning measure and proactive early intervention strategy.

Appendix

Factor Loadings for the SCQ (Glendon & Litherland, 2001)

Label	Item loading	% of variance	Cronbach's α
Factor 1 – Communication and Support		18.3%	.93
1. Work problems are openly discussed between workers and supervisors	.79		
2. Workers are spoken to when changes in work practices are suggested	.78		
3. Workers can express their views about work policy	.77		
4. Workers can discuss important policy issues	.71		
5. Changes in working procedures and their effects on safety are effectively communicated to workers	.69		
6. Workers are told when changes are made to their working environment on a job site	.68		
7. Company policy is effectively communicated to workers	.57		
8. Arrangements are made so workers are not working by themselves	.55		
9. Workers are encouraged to support and look out for each other	.53		
10. Potential risks and consequences are identified in training	.45		
Factor 2 – Adequacy of Procedures		13.7%	.92
11. Work procedures are complete and comprehensive	.79		
12. Work procedures are technically accurate	.79		
13. Work procedures are clearly written	.79		
14. Written work procedures match the way tasks are done is practice	.65		
15. Workers can easily identify the relevant procedure for each job	.56		
16. An effective documentation management system ensures the availability of procedures	.53		
Factor 3 – Work Pressure		13.0%	.89
17. There is sufficient 'thinking time' to enable workers to plan and carry out their work to an adequate standard	.74		
18. There are enough workers to carry out the required work	.71		
19. Workers have enough time to carry out their tasks	.69		
20. Time schedules for completing work projects are realistic	.68		
21. Workload is reasonably balanced	.67		
22. Problems arising form factors outside worker's control can be accommodated without negatively affecting safety	.63		
Factor 4 – Personal Protective Equipment		10.1%	.86
23. PPE use is monitored to identify problem areas	.87		
24. PPE users are consulted for suggested design improvements	.81		
25. Findings from PPE monitoring are acted upon	.78		
26. PPE use is enforced	.50		
Factor 5 – Relationships		7.2%	.82
27. Workers are confident about their future with the organisation	.80		
28. Good working relationships exist in this organisation	.71		
29. Morale is good	.67		
Factor 6 – Safety Rules		6.8%	.72
30. Safety rules are always practical	.74		
31. Safety rules can be followed without conflicting with work practices	.70		
32. Safety rules are followed even when a job is rushed	.62		

References

Baer, M., & Frese, M. (2002). Innovation is not good enough: Climate for initiative and psychological safety, process innovation, and firm performance. *Journal of Organizational Behavior, 24*, 45-68.

Brown, R. L., & Holmes, H. (1986). The use of a factor-analytic procedure for assessing the validity of an employee safety climate model. *Accident Analysis and Prevention, 18*, 455-470.

Cooper, M. D., & Phillips, R. A. (2004). Exploratory analysis of the safety climate and safety behavior relationship. *Journal of Safety Research, 35*, 497-512.

Cox, S., & Flin, R. (1998). Safety culture: Philosopher's stone or man of straw? *Work and Stress, 12*, 189-201.

DeJoy, D. M. (1994). Managing safety in the workplace: An attribution theory analysis and model. *Journal of Safety Research, 25*, 3-17.

Denison, D. R. (1996). What is the difference between organizational culture and organizational climate? A native's point of view on a decade of paradigm wars. *Academy of Management Review, 21*, 619-655.

Diaz, R. I., & Cabrera, D. D. (1997). Safety climate and attitude as evaluation measures of organizational safety. *Accident Analysis and Prevention, 29*, 643-650.

Farrington-Darby, T., Pickup, L., & Wilson, J. R. (2005). Safety culture in railway maintenance. *Safety Science, 43*, 39-60.

Flin, R., Mearns, K., O'Connor, P., & Bryden, R. (2000). Measuring safety climate: Identifying common features. *Safety Science, 34*, 177-192.

Gillen, M., Baltz, D., Gassel, M., Kirsch, L., & Vaccaro, D. (2002). Perceived safety climate, job demands, and coworker support among union and nonunion injured construction workers. *Journal of Safety Research, 33*, 33-51.

Glendon, A. I., & Litherland, D. K. (2001). Safety climate factors, group differences, and safety behaviour in road construction. *Safety Science, 39*, 157-188.

Glendon, A. I., Stanton, N. A., & Harrison, D. (1994). Factor analysing a performance shaping concepts questionnaire. In S. A. Robertson (Ed.), *Contemporary ergonomics 1994: Ergonomics for all.* (pp. 340-345). London: Taylor and Francis.

Griffin, M. A., & Neal, A. (2000). Perceptions of safety at work: A framework for linking safety climate to safety performance, knowledge, and motivation. *Journal of Occupational Health Psychology, 5*, 347-358.

Guldenmund, F. W. (2000). The nature of safety culture: A review of theory and research. *Safety Science, 34*, 215-257.

Hair, J. F., Anderson, R. E., Tatham, R. L., & Black, W. C. (1998). *Multivariate data analysis* (5th ed.). New Jersey: Prentice Hall.

Haworth, N., Tingvall, C., & Kowadlo, N. (2000). *Review of best practice road safety initiatives in the corporate and/or business environment* (No. 166). Clayton: Monash University Accident Research Centre.

Hayes, B. C., Bartle, S. A., & Major, D. A. (2002). Climate for opportunity: A conceptual model. *Human Resource Management Review, 12*, 445-468.

Mearns, K., Flin, R., Gordon, R., & Fleming, M. (1998). Measuring safety climate on offshore installations. *Work and Stress, 12*, 238-254.

Mearns, K., Whitaker, S. M., & Flin, R. (2003). Safety climate, safety management practice and safety performance in offshore environments. *Safety Science, 41*, 641-680.

Neal, A., Griffin, M. A., & Hart, P. M. (2000). The impact of organizational climate on safety climate and individual behaviour. *Safety Science, 34*, 99-109.

Niskanen, T. (1994). Safety climate in the road administration. *Safety Science, 17*, 237-255.

Oliver, A., Cheyne, A., Tomás , J. M., & Cox, S. (2002). The effects of organizational and individual factors on occupational accidents. *Journal of Occupational and Organizational Psychology, 75*, 473-488.

O'Toole, M. (2002). The relationship between employees' perceptions of safety and organizational culture. *Journal of Safety Research, 33*, 231-243.

Reichers, A. E., & Schneider, B. (1990). Climate and culture: An evolution of constructs. In B. Schneider (Ed.), *Organizational climate and culture* (pp. 5-39). Oxford: Jossey-Bass Publishers.

Schneider, B., White, S. S., & Paul, M. C. (1998). Linking service climate and customer perceptions of service quality: Test of a causal model. *Journal of Applied Psychology, 83*, 150-163.

Varonen, U., & Mattila, M. (2000). The safety climate and its relationship to safety practices, safety of the work environment and occupational accidents in eight wood-processing companies. *Accident Analysis and Prevention, 32*, 761-769.

Vredenburgh, A. G. (2002). Organizational safety: Which management practices are most effective in reducing employee injury rates? *Journal of Safety Research, 33*, 259-276.

Watson, B., Fresta, J., Whan, H., McDonald, J., Dray, R., Beuermann, C., et al. (1996). *Enhancing driver management in Queensland*. Fortitude Valley: Queensland Transport.

Wills, A. R., Watson, B., & Biggs, H. C. (2004). *The relative influence of fleet safety climate on work-related driver safety.* Paper presented at the Australasian Road Safety Research, Education and Policing Conference, Perth, Australia, 14-16 November.

Zohar, D. (1980). Safety climate in industrial organizations: Theoretical and applied implications. *Journal of Applied Psychology, 65*, 96-102.

Published as:

Wills, Andrew R and Biggs, Herbert C and Watson, Barry (2005) Analysis of a Safety Climate Measure for Occupational Vehicle Drivers and Implications for Safer Workplaces. *Australian Journal of Rehabilitation Counselling* 11(1):pp. 8-21.