Safety leadership: A meta-analytic review of transformational and transactional leadership styles as antecedents of safety behaviours

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A theoretical model of safety leadership, which incorporated both transformational and active transactional leadership styles, was tested using meta-analytic path analysis. The final model showed that transformational leadership had a positive association with both perceived safety climate and safety participation, with perceived safety climate partially mediating the effect of leadership on safety participation. Active transactional leadership had a positive association with perceived safety climate, safety participation and safety compliance. The effect of leadership on safety compliance was partially mediated by perceived safety climate and the effect on safety participation fully mediated by perceived safety climate. The findings suggest that active transactional leadership is important in ensuring compliance with rules and regulations, whereas transformational leadership is primarily associated with encouraging employee participation in safety. Therefore, in line with the augmentation hypothesis of leadership, a combination of both transformational and transactional styles appeared to be most beneficial for safety. Avenues for further research and practical implications in terms of leadership training and development are discussed.

Practitioner Points

- Developed and tested a model of safety leadership, which shows that both transformational and active transactional leadership styles are important aspects of effective safety leadership.
- Study has implications for practitioners who are involved with the design of leadership training and development programmes, as such programmes should be tailored to focus on a range of leader behaviours that encompass active transactional as well as transformational style.
- Findings suggest that leadership styles have a differential effect on safety compliance and safety participation – thus, training and development programmes should make specific links between leader behaviours and their subsequent influence on employee behaviour.

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Although the importance of managerial leadership for the improvement of workplace safety is well-established, there has been little theoretical development of the overall concept of safety leadership. Recently, interest in leadership as an antecedent of employees' safety perceptions, attitudes and behaviour has increased, with the majority of this research emphasizing the positive influence of transformational leadership (e.g., Barling, Loughlin, & Kelloway, 2002; Conchie & Donald, 2009; Kelloway, Mullen, & Francis, 2006; Zohar & Luria, 2004). Nevertheless, there remains relatively little understanding of the extent to which effective safety leadership can be explained in terms of the effects of transformational leadership per se, or whether safety leadership as a construct requires further development. The aim of this article is to explore further the role of leadership as an antecedent of safety behaviours, extending the discussion of leadership influence beyond that of transformational style.

**Developing a theoretical framework for safety leadership**

Some of the earliest work on leadership style and workplace safety focused on the role of relationship-oriented leadership, such as supervisory consideration (Fleishman, Harris, & Burtt, 1955) and managerial concern for subordinates' well-being (Dunbar, 1975). Relationship-oriented leadership is enacted through a process of social exchange with subordinates, whereby mutual trust and liking is developed; in exchange for leaders' concern for their safety and well-being, subordinates will demonstrate greater willingness to engage in any behaviour linked to improved performance, including safety participation (i.e., willingness to engage in safety activities) and safety compliance (i.e., following safety rules and regulations). Supporting empirical studies have found that high levels of leader–member exchange (LMX) lead to fewer safety-related incidents and lower levels of accident involvement (Hofmann & Morgeson, 1999; Michael, Guo, Wiedenbeck, & Ray, 2006). Further work has suggested that the concept of ‘transformational leadership’ (Bass, 1985) has relevance to workplace safety (e.g., Barling et al., 2002); this style of leadership evokes changes in subordinates’ value systems to align them with organizational goals. The theory of social exchange (Gouldner, 1960) is still relevant, as transformational leadership encompasses the dimension of individualized consideration (i.e., leader shows interest in subordinates’ personal and professional development and listens to followers’ needs and concerns). In addition, however, leaders are theorized to influence subordinates through idealised influence (i.e., leader instils confidence and behaves in admirable ways that cause the followers to identify with him/her) and inspirational motivation (i.e., leader inspires others towards goals, provides meaning, optimism and enthusiasm, and articulates a vision that is appealing and inspiring to others). These leader behaviours affect subordinates through the psychological mechanisms of personal identification with the leader and social identification with the work group (Kark, Shamir, & Chen, 2003; Yukl, 1998); subordinates adopt the values espoused by the leader as their own and align their own self-concept with the group. Finally, transformational leaders employ intellectual stimulation (i.e., leader challenges assumptions, takes risks and encourages subordinates to be creative). This final aspect of transformational leadership is enacted through cognitive, rather than affective processes, whereby subordinates develop new ways of solving problems and are encouraged to question the status quo.

Although transformational leadership forms only part of Bass’s (1985) full-range leadership model, there has been considerably greater focus on transformational compared with transactional leadership, both generally in leadership research and more specifically in relation to safety leadership. According to Bass’s (1985) model,
transactional leaders recognize what actions subordinates must take to achieve outcomes and clarify these role and task requirements, so that subordinates are confident in exerting necessary efforts to fulfil leader expectations. Transactional leadership encompasses a number of specific leadership styles: contingent reward (leader clarifies expectations and rewards in exchange for followers meeting expectations); management-by-exception active (MBEA; leader monitors followers' behaviour and takes corrective action prior to the occurrence of serious problems); management-by-exception passive (MBEP; leader monitors followers' behaviour and takes corrective action once problems have occurred); and laissez-faire (the absence of leadership behaviours). Consistent with the findings in the general leadership literature, contingent reward has demonstrated beneficial effects on safety outcomes, leading to fewer injuries (Zohar, 2002). In Zohar's (2002) study, these findings were closely aligned to the effects of transformational leadership, and these two aspects of leadership were also strongly correlated. In contrast, passive leadership (MBEP, laissez-faire) has demonstrated negative effects on workplace safety, including reduced safety compliance and participation (Mullen, Kelloway, & Teed, 2011) and higher injury rates (Kelloway et al., 2006). Such findings are not surprising given that passive leaders tend to ignore safety problems and fail to intervene until difficulties are serious (MBEP) or show complete disinterest in safety (laissez-faire).

One aspect of transactional leadership that has hardly featured in safety studies is MBEA. Where this leadership style has been investigated, it has tended to be viewed in a negative light, being characterized as 'corrective' leadership (Zohar, 2002) or included in broader measures of passive leadership (Luria, 2008). Indeed, Zohar (2002) reported that MBEA behaved much as MBEP in relation to safety outcomes and the two aspects of transactional leadership were closely correlated. Such findings may reflect the operational definition of MBEA (most commonly measured by the Multi-Factor Leadership Questionnaire (MLQ); Bass & Avolio, 1995) in terms of looking for mistakes or enforcing rules to avoid mistakes, which place a negative spin on its meaning. Yukl (1999) argues that the MLQ scale items emphasize intrusive, controlling forms of monitoring and lack any indication of how the leader corrects those mistakes that are discovered. Furthermore, Yukl (1999) emphasizes that monitoring of subordinate performance can be carried out in a variety of ways, which may facilitate transformational as well as transactional leadership. Indeed, the theoretical description of MBEA leadership is not fully reflected within the MLQ scale, nor does this measure allow for transformational effects to be elicited. Nevertheless, Judge and Piccolo (2004) found that MBEA had small, positive associations with all outcome criteria \( (\rho = .15) \), the strongest associations being with leader effectiveness \( (\rho = .21) \) and follower satisfaction with leader \( (\rho = .24) \). Of particular note is the finding that these relationships were extremely variable, suggesting the presence of moderators. The meta-analysis also showed that MBEA had a significant negative relationship with laissez-faire \( (\rho = -.51) \) and a small positive relationship with transformational leadership \( (\rho = .17) \); in the latter case, 80% credibility intervals ranged from \(-.36 \) to \(.69 \), demonstrating the situational variability within this relationship. More recently, Griffin and Talati (2011) conducted a meta-analysis of MBEA with a range of outcome variables; this study showed that MBEA had positive associations with leader effectiveness \( (\rho = .16) \) and extra effort \( (\rho = .26) \). The authors argued that the relationship between MBEA and work outcomes would be moderated by leadership context (as a proxy for the work context). They found some support for their argument given that MBEA was more strongly predictive of leader effectiveness when the MBEA context was high (i.e., MBEA leadership would be considered the norm in this context and, therefore, foster more positive views). Considering those contexts where MBEA leadership may be
viewed as the norm, this type of leadership would be found most frequently within work environments characterized by a strong emphasis on error management, such as safety-critical organizations (Griffin & Talati, 2011). However, currently, there has been little research to investigate this possibility. As noted previously, one of the limitations of the meta-analysis was that MBEA was measured using existing instruments (mostly MLQ), which would tend to underestimate the positive influence of this form of leadership.

Given the lack of focus on MBEA or active transactional leadership, we have little understanding of the potential positive effects of this form of leadership style. However, drawing on the safety literature, there are strong theoretical reasons for believing that active transactional leadership should have a positive role to play in workplace safety. Active leaders (based on the definition of MBEA) monitor subordinates’ behaviour, anticipate problems and take proactive steps to implement corrective actions. In contrast, passive leaders wait until the behaviour has created problems before taking any action. This is a crucial difference for safety-critical organizations as major disasters may be averted through the proactive monitoring and correction of errors before they lead to problems. Active transactional leadership provides the opportunity for error recovery and learning from mistakes, which are key elements of a ‘learning culture’ (Reason, 1997). Safety-critical organizations aim to foster safety cultures characterized by organizational and individual learning, rather than allocating blame for mistakes; this ‘just culture’ promotes an appropriate balance between learning and accountability (Dekker, 2008; Reason, 1997). It is instructive to draw on the work that has been performed to understand high-reliability organizations (HROs) that operate within high-risk environments, but with an exemplary level of safety performance (e.g., LaPorte & Consolini, 1991; Roberts, 1989; Weick, Sutcliffe, & Obstfeld, 1999). HROs are characterized as having a ‘preoccupation with failure’ (Weick & Sutcliffe, 2001) where the focus is on early detection of problems. Many of the strategies used by HROs help the organization identify problems before they escalate beyond recovery. Such organizations have requirements for compliance, reliability and integrity to ensure safety. Consequently, there is the need for a high level of standardization within high-risk systems (such as railway networks, nuclear power plants and aviation) to avoid system failure. This means that individuals must be risk-aware, but also rule-compliant, to meet the need for concurrent standardization and flexibility required in HROs (Grote, Weichbrodt, Gunter, Zala-Mezo, & Kunzle, 2009). Although it might be argued that HROs operate in very specific, safety-critical environments (such as air traffic control and chemical plants), the principles of HROs have been successfully transferred to work environments as diverse as health care (Reason, 2000; Riley, 2009; Tamuz & Harrison, 2006) and schools (Bellamy, Crawford, Marshall, & Coulter, 2005).

Relationship between safety leadership and safety behaviours
It may be argued that effective safety leadership should incorporate the principles of both transformational and active transactional leadership. Indeed, the augmentation hypothesis, that transformational leadership builds on a foundation of successful transactional leadership, has found empirical support (e.g., Bass, Avolio, Jung, & Berson, 2003; Waldman, Bass, & Yammarino, 1990). A combination of both transformational and active transactional leadership styles should result in effective management of workplace safety, as it brings together leader behaviours that ensure safety through the encouragement of positive engagement with safety as well as safety compliance. Building on this theoretical base, this study uses meta-analysis to examine the relationships between leadership style and safety-related behaviours.
Transformational leadership is believed to operate through four distinct, but closely correlated, components of leader behaviour, which encourage employees to exceed expectations in terms of their own behaviour. In relation to safety, leaders high in idealised influence should demonstrate the priority given to safety through their own behaviour; those high in inspirational motivation should encourage employees to reach high levels of safety; intellectual stimulation should lead to employees suggesting new and innovative ways of reaching safety targets; and finally, leaders high in individualized consideration should demonstrate concern for their employees’ safety and well-being (Barling et al., 2002; Glendon, Clarke, & McKenna, 2006). These leader behaviours will likely affect employees’ task performance in general, as well as specifically related to safety, as such a transformational leadership style develops trust and enhances interpersonal relationships between managers and their subordinates. In a safety context, transformational leadership has been shown to lead to a better understanding of safety issues and improved communication (Conchie, Taylor, & Donald, 2012). Although empirical studies have demonstrated positive effects, it is possible that some aspects of transformational leadership could have deleterious effects on safety, such as the association of intellectual stimulation with risk-taking, given that this aspect of leadership encourages novel and creative ways of thinking. Rafferty and Griffin (2004) define intellectual stimulation as ‘enhancing employees’ interest in, and awareness of problems, and increasing their ability to think about problems in new ways’ (p. 333), which would suggest that rather than encouraging risk-taking, intellectual stimulation allows employees to gain a fresh awareness and understanding of safety problems, encouraging innovative, rather than risky solutions. This latter argument is supported with empirical evidence that leaders perceived to be intellectually stimulating tend to lead the safest business units (Yule, 2002). On balance, therefore, it is hypothesized that transformational leadership style will promote employee safety-related behaviour (H1) and will have a positive non-zero effect on (a) safety participation and (b) safety compliance.

Active transactional leaders are involved with proactive monitoring of employees’ behaviour and correcting errors before they lead to problems. Such leader behaviour should promote close attention to safety rules and regulations by employees, leading to greater safety compliance. Furthermore, the emphasis on individual learning and proactive error management demonstrated by active transactional leaders should encourage employees themselves to engage in safety-related activities. Therefore, it is hypothesized that this leadership style will promote higher levels of safety performance, in terms of safety participation (H2a) and safety compliance (H2b).

**Differential prediction of safety behaviour**

There has been little research to date that has examined differential predictors of safety compliance and participation. Although closely correlated, these are distinct forms of behaviour, with compliance relating to in-role behaviour, such as following safety rules and regulations, and participation relating to extra-role or organizational citizenship behaviours (OCBs), such as helping co-workers, making safety suggestions and engaging in safety activities and training (Neal, Griffin, & Hart, 2000). Although a meta-analysis by Christian, Bradley, Wallace, and Burke (2009) found that safety participation was more closely related to transformational leadership than safety compliance, these relationships were based on small samples, and in each case, the confidence intervals overlapped. A further meta-analysis by Nahrgang, Morgeson, and Hofmann (2011) showed that leadership (broadly defined) was closely related to both compliance and engagement
(where engagement included safety participation, but was more wide-ranging). Thus, the empirical evidence to date has suggested that leadership acts as an antecedent to safety behaviours, but has provided little insight into the type of leader behaviours that may differentially predict participation and compliance. Nevertheless, considering the psychological mechanisms that underlie the effects of transformational and active transactional leadership, one would expect that these differing leadership styles would have differential effects on employees’ behaviour. Transformational leadership generates trust between managers and their subordinates, and therefore encourages employees to go beyond formal role obligations (Podsakoff, MacKenzie, Moorman, & Fetter, 1990). Thus, it would be expected that transformational leadership would lead to compliance, but more particularly would encourage safety participation, as a form of safety citizenship behaviour. Indeed, a recent study by Conchie et al. (2012) found that affect-based trust acted as a mediating variable between safety-specific transformational leadership (characterized by actions that promote shared group values, a vision for the future and individualized support to achieve safety goals) and ‘safety voice’ (speaking up about safety issues). Furthermore, Ford and Tetrick (2011) showed that psychological empowerment and organization identification were both significant predictors of safety participation, but not safety compliance (use of personal protective equipment [PPE]). Transformational leadership would promote both a sense of identification with the organization (through inspirational motivation, as employees accept organizational goals as their own) and psychological empowerment (through intellectual stimulation, as the leader challenges subordinates to be questioning and creative). This would support the idea that transformational leadership is more likely to promote participation than compliance. Active transactional leadership, on the other hand, would be more strongly associated with an emphasis on rule-based compliance as this leadership style is characterized by the active monitoring of employees. Thus, one would expect a relationship with safety participation (as there is a strong emphasis on the importance of safety), but a stronger relationship with safety compliance. Therefore, given the nature of the differing styles, it is hypothesized that safety compliance is more strongly associated with active transactional leadership (H3) and safety participation is more strongly associated with transformational leadership (H4).

The mediation role of perceived safety climate
Early work has drawn attention to the role of managerial leadership in shaping the organizational climate, which in turn affects employees’ attitudes and behaviour (Dunbar, 1975; Schneider, 1983). Subsequent work has explored the relationship between leadership and climate, demonstrating that leadership acts an antecedent of employees’ climate perceptions (Kozlowski & Doherty, 1989). Climate perceptions represent the individual’s cognitive interpretations of the organizational context, bridging the effects of this wider context on individual attitudes and behaviour. In relation to safety, Zohar (1980) argued for the existence of a facet-specific climate for safety, which represents employees’ perceptions of the relative priority of safety in relation to other organizational goals. In subsequent work, safety climate has been operationalised as a group-level construct (Zohar, 2000), and so researchers have aggregated climate perceptions to represent the shared perceptions at this level. Safety climate can also be considered as an individual-level construct, where perceived safety climate represents ‘individual perceptions of policies, procedures and practices relating to safety in the workplace’ (Neal & Griffin, 2006, p. 946–947). There is empirical support for a significant relationship
between individual perceptions of safety climate and future experience of occupational injuries (Huang et al., 2012). At an individual level, employees’ perceptions reflect the psychological climate, rather than climate at a group or organizational level (James & Jones, 1974). Empirical work has suggested a significant association between leadership style and perceived safety climate; for example, safety-specific transformational leadership style has been shown to be related to a more positive safety climate (Barling et al., 2002), and passive leadership has demonstrated a relationship with poorer safety climate (Kelloway et al., 2006). Employees who see encouragement for their involvement and participation are more likely to perceive that safety is given a high priority, leading to more positive perceptions of the safety climate. Therefore, it is hypothesized that transformational leadership will have a positive non-zero effect on perceived safety climate (H5).

Empirical support for the mediating role of perceived safety climate, facilitating the link between leadership behaviour and employee safety, comes from a number of studies (e.g., Barling et al., 2002; Clarke & Ward, 2006; Kelloway et al., 2006). For example, Clarke and Ward (2006) found that leader influence tactics were associated with employees’ engagement with safety (safety participation): perceived safety climate fully mediated the effect of inspirational appeals and partially mediated the effects of both rational persuasion and consultation. Furthermore, Clarke (2010) showed that employees’ perceptions of leadership (broadly defined) had an indirect effect on safety behaviours (including both participation and compliance) partially mediated by perceived safety climate. Given that leadership influences employees through the shaping of climate perceptions, it is expected that perceived safety climate will partially mediate the effects of leadership style on safety behaviours, both for transformational (H7a) and for active transactional leadership (H7b).

The hypothesized model is presented in Figure 1 and represents the distinct relationships that have been hypothesized. In addition, paths are shown between safety behaviours (i.e., compliance and participation) and occupational injuries (i.e., injuries

![Figure 1. Hypothesized model of the paths linking safety leadership, perceived safety climate and safety behaviour.](image-url)
sustained by employees in the workplace). These relationships are well-established in the literature (e.g., Clarke, 2006a; Nahrgang et al., 2011) and so are not specifically examined as hypotheses in this article. The hypothesized model will be tested using a method that combines meta-analysis with structural equation modelling (SEM). This article makes a unique contribution to the literature in testing a novel theoretical framework of safety leadership, which yields specific recommendations for leadership development and training for the enhancement of workplace safety.

**Method**

To test the hypothesized model, the first step was to conduct a systematic search of the literature and identify relevant studies for inclusion in the meta-analysis. Secondly, data from these studies were coded and analysed to produce a set of meta-analytic correlations. Finally, these correlations were input as a correlation matrix to test the hypothesized model using SEM.

**Literature search**

A systematic search of the literature was conducted, using a computerized search of the PsycInfo, Medline and ABI-inform databases. Studies were identified that contained the following combination of keywords: at least one of safety climate, safety behavio(u)r, safety compliance, safety participation, injuries and leadership. The databases were searched for records from all entries up to, and including, the year 2011. In addition, recent articles and articles in press were sought via the websites of the following journals: Accident Analysis & Prevention; Journal of Applied Psychology; Journal of Occupational & Organisational Psychology; Journal of Occupational Health Psychology; Journal of Organizational Behaviour; Journal of Safety Research; and Safety Science. Studies identified in the reference sections of recent safety meta-analyses, together with the reference sections of all relevant papers located in the literature search were manually searched to identify any further articles. This initial search yielded more than 800 papers. Of those identified through this process, studies were retained if they included relevant measures, all data were measured at the individual level and drawn from organizational samples. This filtering process resulted in a total of 103 studies (114 independent samples) to be included in the analysis (N = 80,160); of this total, 32 studies (37 independent samples) were found which measured leadership (N = 24,363) in relation to safety-related variables and so formed the key data set of interest in the current analysis (see Appendix A). For each study, effect sizes between variables of interest, sample sizes and reliability information (where specified) were recorded.

**Coding of studies**

Leadership style was coded into two categories: transformational (e.g., transformational [MLQ], safety-specific transformational, LMX, empowering, resonant, coaching/caring, drives/encourages); active transactional (e.g., monitoring, controlling, monitoring & action, providing feedback). LMX was coded into the transformational leadership category as it has been argued that high LMX reflects ‘transformational social exchange’ in terms of psychological benefits, such as trust, esteem and support (Graen & Uhl-Bien, 1995). Although it has also been discussed that LMX may encompass both transformational and transactional elements, in this case, low LMX did not match the current
definition of active transactional leadership behaviour and so was not coded in relation to this category. Safety behaviour was also coded into two categories: safety compliance and safety participation. Safety compliance was coded as follows: compliance with rules or procedures, use of PPE, safe work behaviours (which referred to following rules), unsafe work behaviours or violations (reverse coded) and measures of safety compliance. Safety participation was coded as: participation in health and safety activities, safety citizenship behaviour, making safety suggestions, safety-related worker involvement, ensuring co-worker safety and measures of safety participation. Additional categories were coded for perceived safety climate and occupational injuries.

Measures of perceived safety climate may either reflect the overall priority given to safety in relation to other organizational goals (i.e., global or generic measures) or may reflect more specific indicators of safety climate, such as management commitment to safety. As management commitment to safety (as reflected in managers’ values, attitudes, actions and support for safety) is often considered as the core theme of safety climate (Flin, Mearns, O’Connor, & Bryden, 2000; Zohar, 2010), researchers may use this variable interchangeably with safety climate. Therefore, the category for perceived safety climate comprised measures of overall safety climate; management commitment to safety; management attitudes to safety; perceived managerial safety values; management safety practices; and management support for safety.

The category for occupational injuries was coded as the frequency of work-related injuries, either self-reported or though company reports. Measures varied from those that recorded self-reported (unspecified) work injuries to those that included a description of specific injuries (e.g., strains/sprains, cuts/lacerations, bruises/contusions). All measures reflected individual-level data, related to the individual’s own injury experience (whether self-reported or based on company reports).

Coding for all variables was conducted by two independent raters. The initial inter-rater agreement was 92%. Differences of opinion were resolved through discussion to reach consensus.

Correlation coefficients were obtained for the relationship between each pair of categories. Where more than one correlation coefficient represented a relationship, the mean value was calculated and included in the meta-analysis. Separate correlation coefficients were included for each independent sample.

**Meta-analysis**

The procedures described by Hunter and Schmidt (2004) were used to calculate validity coefficients. To estimate the true correlations, the validity coefficients were corrected for both criterion and predictor unreliability for each analysis. As not all the artefact information was available in the individual studies to correct each correlation for unreliability, information was gathered from studies in the current meta-analysis to calculate an average reliability distribution for each variable.

**Structural equation modelling**

Structural equation modelling analysis was conducted using the AMOS programme (Arbuckle, 2005). The hypothesized model linking leadership styles, safety climate, safety participation and safety compliance was specified (see Figure 1). To account for the covariance between leadership styles and between employee behaviours (compliance and participation), in both cases, the residuals were allowed to freely covary. Given that
the meta-analytic correlations had varying sample sizes, the harmonic mean of sample sizes \((N = 229)\) was used for the SEM analysis as recommended by Viswesvaran and Ones (1995). Model fit was assessed using chi-squared goodness-of-fit test, root mean square error of approximation (RMSEA; Steiger, 1990), Tucker–Lewis Index (TLI; Tucker & Lewis, 1973), normed fit index (NFI; Bentler & Bonett, 1980) and comparative fit index (CFI; Bentler, 1990). For the NFI, CFI and TLI values > .95 indicate good fit (Hu & Bentler, 1999), whereas for RMSEA, a value < .05 is indicative of good fit (Browne & Cudeck, 1993).

Results

The results of the meta-analysis are shown in Table 1. The hypotheses related to transformational leadership were all supported: this style had a positive, non-zero association with safety participation (H1a), safety compliance (H1b) and perceived safety climate (H5). The strongest relationships were moderate effect sizes for both perceived safety climate \((\rho = .48, p < .05)\) and safety participation \((\rho = .44, p < .05)\), reflecting the importance of a transformational style in promoting perceptions that safety is highly valued in relation to other organizational goals, and encouraging active employee engagement with safety activities. A significant, but smaller, effect size was found between transformational leadership and safety compliance \((\rho = .31, p < .05)\). The hypotheses related to active transactional leadership were also supported: positive, non-zero associations were found with safety participation (H2a), safety compliance (H2b) and perceived safety climate (H6). The relationship between active transactional leadership and perceived safety climate was a moderate effect size \((\rho = .57, p < .05)\), indicating the importance of active leader behaviours in promoting perceptions that safety is highly valued in relation to other organizational goals. Indeed, the relationship between perceived safety climate and active transactional leadership was stronger than that between perceived safety climate and transformational leadership. There were also significant relationships between active transactional leadership and both safety compliance \((\rho = .41, p < .05)\) and safety participation \((\rho = .36, p < .05)\).

Safety compliance was more strongly related to active transactional leadership \((\rho = .41)\) than transformational leadership \((\rho = .31)\), and safety participation was more strongly related to transformational \((\rho = .44)\) than active transactional leadership.

### Table 1. Meta-analytic correlations for the relationships between leadership styles, perceived safety climate and safety behaviour

<table>
<thead>
<tr>
<th>Variables</th>
<th>k</th>
<th>N</th>
<th>r</th>
<th>SD(r)</th>
<th>(\rho)</th>
<th>SD((\rho))</th>
<th>90% LCI</th>
<th>90% UCI</th>
<th>% Var</th>
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<tbody>
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<tr>
<td>Compliance</td>
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<td>4006</td>
<td>.29*</td>
<td>.11</td>
<td>.31</td>
<td>.11</td>
<td>.17</td>
<td>.46</td>
<td>88</td>
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<tr>
<td>Participation</td>
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<td>2871</td>
<td>.40*</td>
<td>.14</td>
<td>.44</td>
<td>.15</td>
<td>.25</td>
<td>.64</td>
<td>16</td>
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<tr>
<td>Safety climate</td>
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<td>5208</td>
<td>.45*</td>
<td>.16</td>
<td>.48</td>
<td>.17</td>
<td>.26</td>
<td>.70</td>
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<td><strong>Active transactional leadership</strong></td>
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<tr>
<td>Compliance</td>
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<td>2958</td>
<td>.37*</td>
<td>.07</td>
<td>.41</td>
<td>.08</td>
<td>.31</td>
<td>.51</td>
<td>30</td>
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<tr>
<td>Participation</td>
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<td>992</td>
<td>.32*</td>
<td>.05</td>
<td>.36</td>
<td>.05</td>
<td>.29</td>
<td>.43</td>
<td>67</td>
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<tr>
<td>Safety climate</td>
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<td>.52*</td>
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<td>.57</td>
<td>.14</td>
<td>.39</td>
<td>.74</td>
<td>12</td>
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Note. *\(p < .05\) (where 95% confidence intervals did not include zero); 90% LCI, lower boundary of 90% credibility interval; 90% UCI, upper boundary of 90% credibility interval; % Var, % variance accounted for by statistical artefacts.
Although these findings were in the direction hypothesized, the differences were not significant at the 5% level (given the overlap in confidence intervals) and, therefore, cannot be taken as fully supporting hypotheses 3 and 4.

**Testing the hypothesized model using SEM**

To test the hypothesized model, a number of additional meta-analytic correlations were calculated (see Appendix B for full meta-analytic correlation matrix). The goodness-of-fit statistic for the hypothesized model (see Figure 1) was not significant \[ \chi^2 (3) = 5.075, \ p = .166 \], indicating that the model is a good fit to the data. In addition, the alternative goodness-of-fit statistics also suggested a good fit [NFI = .987; CFI = .994; TLI = .972; RMSEA = .055]. The values of NFI, TLI and CFI all exceeded the critical level of .95, and the RMSEA marginally exceeded the critical value of .05. However, examination of the parameter estimates for this model revealed that some of the hypothesized relationships were not statistically significant, indicating that the model included a degree of statistical redundancy. The non-significant paths represented the relationships between transformational leadership and safety compliance and between active transactional leadership and safety participation. To produce a more parsimonious model, these non-significant paths were removed, given that the deletion of these paths produced a model that was theoretically plausible and consistent with previous arguments. The goodness-of-fit statistics suggested that this model was a good fit to the data \[ \chi^2 (5) = 5.675, \ p = .339; \ NFI = .985; \ CFI = .998; \ TLI = .994; \ RMSEA = .024 \]. In this case, the value of RMSEA was below the critical level of .05, indicating a good fit. This model supports hypotheses 3 and 4, which suggested differential predictors for safety compliance and safety participation. Perceived safety climate appears to have a key role in mediating the effects of both leadership styles on both safety compliance and safety participation (consistent with hypotheses H7a and H7b). Consistent with previous research, the parameter estimates for the relationships between safety behaviour (compliance and participation) and occupational injuries were significant, supporting a link to safety outcomes.

**Testing the mediation role of perceived safety climate**

The hypothesized model suggests that perceived safety climate partially mediates the effects of both transformational leadership (H7a) and active transactional leadership (H7b) on safety compliance and participation. This model (Model 1) was compared with two theoretically plausible alternative models, where perceived safety climate fully mediates the effects of leadership (Model 2) and where perceived safety climate plays no mediating role (Model 3). Both alternative models are nested within the hypothesized partial mediation model (Model 1) and so can be compared using the chi-squared difference test (Anderson & Gerbing, 1988). The alternative models were estimated using SEM (see Table 2).

The hypothesized partial mediation model (Model 1) had significantly better fit compared with the full mediation model (Model 2), \( \Delta \chi^2 (2) = 35.02, \ p < .001 \) and compared with the non-mediation model (Model 3), \( \Delta \chi^2 (2) = 9.732, \ p < .001 \). These findings support the partial mediation role of perceived safety climate hypothesized in relation to both transformational (H7a) and active transactional leadership (H7b) styles. The final model, which excludes direct paths from active transactional leadership to safety participation and
from transformational leadership to safety compliance, is presented in Figure 2 (parameter estimates of significant paths are shown). Sobel tests (Sobel, 1982) were conducted to test the significance of the mediating pathways. The indirect path of active transactional leadership to safety participation, mediated by perceived safety climate, was significant (\(z = 3.32, p < .001\)); similarly, the indirect path of active transactional leadership to safety compliance, mediated by perceived safety climate, was also significant (\(z = 2.34, p < .01\)). Although the indirect path of transformational leadership to safety participation, mediated by perceived safety climate, was significant (\(z = 2.27, p < .05\)), the indirect path of transformational leadership to safety compliance was not significant at the 5% level (\(z = 1.87, p < .10\)).

The relative effects of transformational and active transactional leadership are shown in Table 3. This demonstrates that although both types of leadership have a significant association with safety behaviour, transformational leadership plays a more important role in relation to safety participation, whereas active transactional leadership has greater relevance to safety compliance. These findings are supportive of the differential effects of leadership style on safety behaviour. The overall effectiveness of transformational leadership (.44) reported by Judge and Piccolo (2004) is somewhat larger than the effect found for safety participation (.36). In contrast, the effect for active transactional leadership on safety compliance (.38) is considerably larger than the overall effectiveness of MBEA leadership (.15) reported previously (Judge & Piccolo, 2004).

### Discussion

The current study highlights the importance of leadership style as an antecedent of safety perceptions and behaviour. In particular, the contribution of an active transactional leadership style is recognized in addition to transformational leader behaviours in promoting perceptions of a positive safety climate and ensuring safe behaviour at work. The findings indicate that there is empirical evidence to support a role of active transactional leadership that is distinct from transformational leadership, suggesting that the overall concept of safety leadership needs to be extended beyond the idea of transformational leadership to include other types of leader behaviour. Although the role of transformational leadership in relation to safety was supported in line with previous research, the findings indicate that active transactional leadership behaviours (which capture aspects of monitoring, proactive approach to potential problems and feedback on errors) are also critical. Little previous work has investigated the role of transactional leadership in relation to safety, but existing evidence has suggested that ‘corrective’ leadership played little or no part in enhancing safety (Luria, 2008; Zohar, 2002); on the

### Table 2. Model fit statistics for nested structural models testing hypothesized mediating effect of perceived safety climate

<table>
<thead>
<tr>
<th>Model</th>
<th>(\chi^2)</th>
<th>df</th>
<th>(\Delta \chi^2)</th>
<th>df</th>
<th>NFI</th>
<th>TLI</th>
<th>CFI</th>
<th>RMSEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1 partial mediation</td>
<td>5.68</td>
<td>5</td>
<td></td>
<td></td>
<td>.985</td>
<td>.994</td>
<td>.998</td>
<td>.024</td>
</tr>
<tr>
<td>Model 2 full mediation</td>
<td>40.7*</td>
<td>7</td>
<td>35.02*</td>
<td>2</td>
<td>.894</td>
<td>.804</td>
<td>.908</td>
<td>.145</td>
</tr>
<tr>
<td>Model 3 non-mediation</td>
<td>103.0*</td>
<td>7</td>
<td>97.32*</td>
<td>2</td>
<td>.731</td>
<td>.441</td>
<td>.739</td>
<td>.245</td>
</tr>
</tbody>
</table>

Note. \(N = 229\); \(\Delta \chi^2\), change in chi-squared between models 1 and 2, and models 1 and 3; NFI, normed fit index; TLI, Tucker–Lewis index; CFI, comparative fit index; RMSEA, root mean square error of approximation; *\(p < .001\).
contrary, the current study supported hypotheses that active transactional leadership was positively related to perceived safety climate, safety behaviour and, subsequently, to safety outcomes.

Figure 2. Final model of relationships between leadership, perceived safety climate, safety. Note: all path coefficients significant at $p < .05$; covariance between residuals for safety participation safety compliance is not shown.

Table 3. Summary of the direct and indirect effects of leadership style on employees’ safety behaviour

<table>
<thead>
<tr>
<th></th>
<th>Safety compliance</th>
<th>Safety participation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Transformational leadership</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct effect</td>
<td>–</td>
<td>.31**</td>
</tr>
<tr>
<td>Indirect effect$^a$</td>
<td>.04 (ns)</td>
<td>.05*</td>
</tr>
<tr>
<td>Overall effect</td>
<td>.04</td>
<td>.36</td>
</tr>
<tr>
<td><strong>Active transactional leadership</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct effect</td>
<td>.30**</td>
<td>–</td>
</tr>
<tr>
<td>Indirect effect$^a$</td>
<td>.08**</td>
<td>.11**</td>
</tr>
<tr>
<td>Overall effect</td>
<td>.38</td>
<td>.11</td>
</tr>
</tbody>
</table>

Note. $^a$Indirect effect is mediated by perceived safety climate; $^* p < .05$, $^** p < .01$, ns, not significant.
Although the meta-analysis showed that both types of leadership were significantly associated with both types of safety behaviour, the final path model demonstrated that direct effects for transformational leadership (safety compliance) and active transactional leadership (safety participation) were non-significant. This model was an excellent fit to the data. The findings suggested that while it may be possible to ensure safety compliance through the use of active transactional leadership alone, this style has only an indirect effect on safety participation (mediated by perceived safety climate). A more effective means of encouraging safety participation can be achieved through the use of a transformational leadership style. These findings support the idea of differential effects of antecedents on safety participation and safety compliance. It should be noted that the final model was derived by the deletion of paths from the hypothesized model. Thus, the final model should be verified through independent cross-validation studies (MacCallum, 1995). Previous research has presented little evidence of such effects, and so further research is needed to explore ways in which antecedents, such as leadership, may be used to enhance different types of employees’ safety behaviour.

The current results showed that active transactional leadership not only ensures safety compliance, but has an important role in shaping employees’ perceptions regarding the importance of safety. A strong relationship between active transactional leadership and perceived safety climate was found indicating that this form of leadership could play a significant role in promoting a positive safety climate. This finding may reflect previous literature which suggested that visible management actions are an important factor in relation to safety (e.g., Brown & Holmes, 1986; Cooper & Phillips, 2004). Transformational leaders may be viewed as ‘paying lip service’ to safety issues, whereas the critical element of active transactional leaders is that they are seen to ‘walk the talk’: transactional behaviours, such as active monitoring and intervention when problems occur, demonstrate clearly to employees in a highly visible way the importance attached to their work activities in terms of safety. Such behaviours would result in the daily reinforcement of safety as part of employees’ work role. This distinction is discussed by Zohar (2010) in terms of espoused and enacted priorities, whereby espoused priorities are reflected in organizational policies, procedures and practices, but that enacted priorities may differ as these reflect the daily reality of the importance accorded to safety in practice.

A partial mediation model was hypothesized and supported. This model was found to have a significantly better fit than the alternative model proposing full mediation. While these findings signal the mediating role of perceived safety climate between leadership style and employees’ safety behaviour, as found in previous research, the importance of direct effects of leadership style on employees’ behaviour was also indicated. Indeed, the direct effects of leadership were found to be more substantial than the indirect effects. Although further research is needed to understand these direct effects, existing studies have offered some insight. For example, Clarke and Ward (2006) found that rational persuasion was an effective influence tactic for leaders encouraging safety participation. Although this leader behaviour was not examined in relation to safety compliance, as it involves providing a logical rationale, this may lead to greater understanding of why procedures and rules operate in the way that they do and so encourage safety compliance. Further research into the type of behaviours used by both transformational and transactional leaders will aid in the development of more effective leadership training and development programmes.
Limitations

There are a number of limitations with the current research. First, it must be noted that there are relatively few studies that have measured aspects of active transactional leadership in relation to safety. It is hoped that the findings of the current paper will provide motivation for researchers to explore this aspect of leadership further in relation to safety. Second, the cross-sectional nature of much of the data in the meta-analysis means that causal links cannot be drawn from the analyses. Directionality of relationships is shown in the model, but this requires experimental or longitudinal tests to provide confirmatory evidence. Indeed, it is plausible that some relationships are reciprocal.

As a leader does not necessarily treat all group members in the same fashion, leadership style was considered as an individual-level variable in the current paper. Safety climate was also modelled in the current research as perceptions of safety at an individual level. Nevertheless, researchers have operationalised safety climate as a group-level variable, given its definition as shared perceptions of safety priority within a group or team. Future research may be able to combine both individual- and group-level effects within the same model to explore these effects further.

Implications for research and practice

Additional work is needed to further the theoretical development of the concept of safety leadership. Although we have a good understanding of some of the psychological mechanisms that operate in relation to transformational leadership, further research should look at those mechanisms related to active transactional leadership. It may be argued that transactional behaviours, such as setting expectations and giving feedback, will improve employees’ motivation (Locke & Latham, 1990) and encourage individual learning. Furthermore, making explicit and clarifying the relationship between employees’ actions and subsequent rewards will also enhance motivation (Vroom, 1964). In relation to safety outcomes, transactional leader behaviours, such as monitoring and taking corrective action, would not necessarily be seen as punitive, especially within a positive safety climate, which encourages error management. Within such an environment, these behaviours are more likely to be viewed in a positive light. Further research into active transactional leadership will be hampered by the lack of suitable measures within the current literature. As discussed previously, this aspect of leadership is not adequately captured by existing measures of MBEA using MLQ. Therefore, there is a need for the development of new measures to reflect active transactional leader behaviours.

The findings have implications for the design of training and development programmes as interventions to improve safety leadership. Although there is evidence that leadership interventions are effective in changing leader behaviour, most of these have focused on transformational leadership (e.g., Barling, Weber, & Kelloway, 1996; Dvir, Eden, Avolio, & Shamir, 2002; Mullen & Kelloway, 2009). There is little guidance available on leadership interventions that focus on a wider range of leader behaviour or focus on the ability to change between leadership styles to fit the requirements of the situation. The current findings would suggest that leaders would benefit from developing a range of leader behaviours that encompass both transformational and transactional aspects. To make the best use of these behaviours, a certain degree of leadership flexibility should also be developed, to judge the most appropriate behaviours to use for the situation (Yukl & Mahsud, 2010).
Conclusions

In summary, this study has developed and evaluated a model of safety leadership that encompasses both transformational and active transactional leadership styles. It is suggested that a combination of both styles will be most effective in managing workplace safety. Differential effects of leadership style were supported in relation to employees' safety-related behaviour. Transformational leadership behaviours were most effective in encouraging safety participation, whereas active transactional leadership behaviours were most effective in promoting safety compliance. These findings should be taken into account in the design of leadership training and development programmes.

References

*References denoted by an asterisk are included in the meta-analysis.


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### Appendix A

**Studies included in the meta-analysis which were coded for leadership and safety-related variables (32 studies)**

<table>
<thead>
<tr>
<th>Study</th>
<th>Leadership measure(s)</th>
<th>Safety climate measure(s)</th>
<th>Safety behaviour and/or outcome measure(s)</th>
<th>Sample description</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barling et al. (2002)</td>
<td>Safety-specific transformational leadership</td>
<td>Safety climate</td>
<td>Occupational injuries</td>
<td>Canadian restaurant employees</td>
<td>174 (S1) / 164 (S2)</td>
</tr>
<tr>
<td>Kelloway et al. (2006)</td>
<td>Safety-specific transformational leadership</td>
<td>Safety climate</td>
<td>Occupational injuries</td>
<td>Canadian university students working part-time</td>
<td>158</td>
</tr>
<tr>
<td>Mullen and Kelloway (2009)</td>
<td>Safety-specific transformational leadership</td>
<td>Safety climate</td>
<td>Safety participation Safety compliance</td>
<td>Canadian health care employees</td>
<td>491</td>
</tr>
<tr>
<td>Yagil and Luria (2010)</td>
<td>LMX (leadership)</td>
<td>Safety climate</td>
<td>Safety compliance</td>
<td>Israeli manufacturing employees</td>
<td>673</td>
</tr>
<tr>
<td>Credo, Armenakis, Field, and Young (2010)</td>
<td>LMX (leadership)</td>
<td>Management safety concern (safety climate)</td>
<td>None</td>
<td>US drilling company – field technicians &amp; project personnel</td>
<td>188</td>
</tr>
<tr>
<td>Kath, Marks, and Ranney (2010b)</td>
<td>LMX (leadership)</td>
<td>Management attitude towards safety (safety climate)</td>
<td>Upwards safety communication (safety participation)</td>
<td>Canadian mechanical employees of railway company</td>
<td>506</td>
</tr>
<tr>
<td>Hofmann and Morgeson (1999)</td>
<td>LMX (leadership)</td>
<td>Safety commitment (safety climate)</td>
<td>Accidents (occupational injuries)</td>
<td>US manufacturing plant employees</td>
<td>49</td>
</tr>
<tr>
<td>Clarke and Ward (2006)</td>
<td>Leader influence tactics</td>
<td>Safety climate</td>
<td>Safety participation</td>
<td>UK manufacturing employees</td>
<td>83 (S1) / 22 (S2) / 566</td>
</tr>
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</table>

*Continued*
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<thead>
<tr>
<th>Study</th>
<th>Leadership measure(s)</th>
<th>Safety climate measure(s)</th>
<th>Safety behaviour and/or outcome measure(s)</th>
<th>Sample description</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Martínez-Córcoles, Gracia, Tomás, and Peiró (2011)</td>
<td>Safety behaviours (safety compliance)</td>
<td>Safety compliance</td>
<td>Spanish nuclear power plant employees</td>
<td>295 (S2)</td>
<td></td>
</tr>
<tr>
<td>Hsu, Lee, Wu, and Takano (2008)</td>
<td>Supervision (monitoring)</td>
<td>Management commitment to safety (safety climate)</td>
<td>Willingness to report (safety participation) Safety compliance</td>
<td>Oil refinery workers in Japan (S1) &amp; Taiwan (S2)</td>
<td>256 (S1)</td>
</tr>
<tr>
<td>Wu, Chang, Shu, Chen, and Wang (2011)</td>
<td>Safety leadership (coaching, caring) Safety leadership (controlling)</td>
<td>Commitment to safety (safety climate)</td>
<td>None</td>
<td>Taiwan chemical material manufacturing company employees</td>
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<td>Niskanen (1994)</td>
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<td>Safety attitudes of supervisors (safety climate)</td>
<td>None</td>
<td>Finnish road maintenance employees</td>
<td>193</td>
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<tr>
<td>Diaz-Cabrera, Hernandez-Fernaud, and Isla-Diaz (2007)</td>
<td>Leadership style</td>
<td>Company safety values (safety climate)</td>
<td>None</td>
<td>Spanish employees (various organisations)</td>
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</tr>
<tr>
<td>Katz-Navon, Naveh, and Stern (2007)</td>
<td>Managerial leadership</td>
<td>Safety priority (safety climate)</td>
<td>None</td>
<td>Israeli nurses</td>
<td>161</td>
</tr>
<tr>
<td>Study</td>
<td>Leadership measure(s)</td>
<td>Safety climate measure(s)</td>
<td>Safety behaviour and/or outcome measure(s)</td>
<td>Sample description</td>
<td>N</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-----------------------</td>
<td>----------------------------</td>
<td>--------------------------------------------</td>
<td>-----------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Mohamed (2002)</td>
<td>Supervisory environment (leadership)</td>
<td>Management commitment to safety (safety climate)</td>
<td>None</td>
<td>Australian construction employees</td>
<td>68</td>
</tr>
<tr>
<td>Ginsburg et al. (2010)</td>
<td>Informal safety leadership (drives and encourages)</td>
<td>Safety climate</td>
<td>None</td>
<td>Patient safety officers in Canadian hospitals</td>
<td>49</td>
</tr>
<tr>
<td>Clarke and Flitcroft (2008)</td>
<td>Transformational leadership</td>
<td>Safety climate</td>
<td>None</td>
<td>UK employees in small and medium-sized businesses (various industries)</td>
<td>463 (S1) 130 (S2)</td>
</tr>
<tr>
<td>Conchie and Donald (2009)</td>
<td>Safety-specific transformational leadership</td>
<td>None</td>
<td>Safety citizenship behaviour (safety participation)</td>
<td>UK construction employees</td>
<td>139</td>
</tr>
<tr>
<td>Inness, Turner, Barling, and Stride (2010)</td>
<td>Transformational leadership</td>
<td>None</td>
<td>Safety participation Safety compliance</td>
<td>US employees (various occupations)</td>
<td>159</td>
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<tr>
<td>Squires, Tourangeau, Spence Laschinger, and Doran (2010)</td>
<td>Resonant leadership LMX (leadership)</td>
<td>Safety climate</td>
<td>None</td>
<td>US nurses</td>
<td>267</td>
</tr>
<tr>
<td>Lu and Yang (2010)</td>
<td>Safety leadership (motivation &amp; concern) Safety leadership (policy)</td>
<td>None</td>
<td>Safety participation Safety compliance</td>
<td>Taiwan container terminal operatives</td>
<td>336</td>
</tr>
<tr>
<td>Mullen et al. (2011)</td>
<td>Safety-specific transformational leadership</td>
<td>None</td>
<td>Safety participation Safety compliance</td>
<td>Canadian young employees (S1) &amp; health-care employees (S2)</td>
<td>241 (S1) 491 (S2)</td>
</tr>
<tr>
<td>Conchie et al. (2012)</td>
<td>Safety-specific transformational leadership</td>
<td>None</td>
<td>Safety citizenship behaviour (safety participation)</td>
<td>Employees at UK oil refinery</td>
<td>150</td>
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<tr>
<td>Michael et al. (2006)</td>
<td>LMX (leadership)</td>
<td>None</td>
<td>Occupational injuries</td>
<td>US manufacturing employees</td>
<td>598</td>
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</table>

Continued
Appendix A (Continued)

<table>
<thead>
<tr>
<th>Study</th>
<th>Leadership measure(s)</th>
<th>Safety climate measure(s)</th>
<th>Safety behaviour and/or outcome measure(s)</th>
<th>Sample description</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Størseth (2006)</td>
<td>People-oriented leadership</td>
<td>None</td>
<td>Risk taking behaviour (safety compliance)</td>
<td>Norwegian employees (various occupations)</td>
<td>729</td>
</tr>
<tr>
<td>Frone (1998)</td>
<td>Supervisory monitoring</td>
<td>None</td>
<td>Occupational injuries</td>
<td>US young employees (various occupations)</td>
<td>1319</td>
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<tr>
<td>Parker, Axtell, and Turner (2001)</td>
<td>Supportive supervision</td>
<td>None</td>
<td>Safe working (safety compliance)</td>
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<td>161</td>
</tr>
<tr>
<td>Lee, Coustasse, and Sikula (2011)</td>
<td>Transformational leadership</td>
<td>None</td>
<td>Occupational injuries</td>
<td>US nursing assistants</td>
<td>2882</td>
</tr>
</tbody>
</table>

Note. S1, S2: independent samples (where study included more than one); none: study did not measure a relevant construct. LMX, leader–member exchange.

Appendix B

Meta-analytic correlations (corrected for unreliability) for all variables (N = 229)

<table>
<thead>
<tr>
<th>Variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Transformational leadership</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Active transactional leadership</td>
<td>.64</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Perceived safety climate</td>
<td>.48</td>
<td>.57</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Safety compliance</td>
<td>.31</td>
<td>.41</td>
<td>.35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Safety participation</td>
<td>.44</td>
<td>.36</td>
<td>.40</td>
<td>.49</td>
<td></td>
</tr>
<tr>
<td>6. Occupational injuries</td>
<td>.22</td>
<td>.14</td>
<td>.17</td>
<td>.21</td>
<td>.21</td>
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</table>