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Research Paper

The role of Employee engagement in Occupational Safety and health: Examining the relationship between employee engagement and safety outcomes

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Abstract
This study examines how employee engagement relates to occupational safety outcomes and under what conditions engagement translates into safer work. Using a time-lagged, multi-source, multilevel design across 162 work teams in manufacturing, energy, logistics, and healthcare, we surveyed employees on engagement and job demands/resources (T1) and, six months later, on safety compliance and safety participation (T2). Team-level safety climate was derived from aggregated perceptions, and monthly administrative records supplied near-miss, recordable (TRIR), and lost-time (LTIR) injury rates over 12 months. Multilevel structural equation modelling showed that T1 engagement positively predicted T2 safety compliance and participation; at the team level, mean engagement strengthened safety climate, which in turn elevated both forms of safety behaviour. Indirect effects (engagement → climate → behaviour) accounted for roughly one-third to one-half of the total association. Negative binomial panel models linked higher compliance and participation—and stronger safety climate—to lower TRIR and LTIR, with mediation analyses indicating that behavioural pathways explained most of the engagement–injury relationship. Moderation tests supported Job Demands–Resources logic: job resources and psychological safety amplified the engagement → participation path, whereas high demands attenuated both compliance and participation effects. Findings position engagement as a safety resource whose benefits depend on context; when paired with supportive climate, adequate resources, and leader behaviours that enable voice, engagement reliably improves safety performance. Practical implications include integrating engagement into ISO 45001 cycles, prioritising safety participation and near-miss learning, balancing workload with guardrails, and developing supervisors as climate multipliers.

Keywords: *employee engagement; safety climate; safety compliance; safety participation; job demands–resources*

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I. Introduction

Across industries, leaders increasingly view employee engagement as a strategic lever not only for productivity and retention but also for safer work. Engagement—typically defined as a positive, fulfilling, work-related state characterised by vigor, dedication, and absorption—shapes how attentively, energetically, and persistently employees enact routine and non-routine tasks (Kahn, 1990; Schaufeli & Bakker, 2004). Because most organisational accidents arise from complex interactions among technical conditions, work design, and human behaviour, the quality of that behavioural engagement matters. Engaged employees are more likely to notice weak signals, raise concerns, and follow through on corrective actions; disengaged employees are more vulnerable to distraction, corner-cutting, and silence in the face of hazards (Neal & Griffin, 2006; Hofmann & Morgeson, 1999). At the system level, organisations that couple engagement with a strong safety climate—shared perceptions that safety is genuinely prioritised—tend to convert policies into reliable practices on the shop floor (Zohar, 1980; Christian et al., 2009).

Yet the engagement–safety link is neither automatic nor uniform. Engagement can be co-opted to intensify pace without corresponding resources, raising cognitive load and fatigue—risk factors for errors and injuries (Bakker & Demerouti, 2007; Nahrgang, Morgeson, & Hofmann, 2011). Engagement also interacts with leadership, job resources, and climate strength; in weak climates, vigor may translate into faster output rather than safer performance. This study therefore examines **how** and **under what conditions** employee engagement relates to safety outcomes, distinguishing safety compliance (rule adherence) from safety participation (discretionary, extra-role safety behaviour), and tracing pathways through safety climate, leadership, and job demands–resources.

Statement of the Problem

Despite widespread claims that "engaged workforces are safer," evidence in many organisations remains indirect, cross-sectional, or confounded by broader culture and leadership effects. Managers invest in engagement initiatives (pulse surveys, recognition schemes, team-building) and in safety programmes (training, audits, behavioural observation) largely in parallel, with limited integration or theory-driven measurement. Three gaps follow. First, **construct clarity**: organisations often conflate engagement with satisfaction or morale, and safety performance with lagging metrics (recordable incident rates) that are insensitive to proximal behavioural mechanisms. Second, **causal ambiguity**: safer sites may make employees feel more engaged, rather than engagement causing safer behaviour; common causes (e.g., supportive leadership) may drive both. Third, **boundary conditions**: the engagement–safety link likely depends on safety climate strength, resource adequacy, and leadership style; without these moderators, engagement could fuel throughput pressures and risk taking. Absent rigorous designs that separate these pathways, organisations risk funding generic "engagement lifts" that do little for safety, or worse, intensify job demands without protective resources. A focused assessment that aligns constructs and methods is needed to identify the conditions under which engagement contributes to safety—and when it does not.

Purpose of the Study

The purpose of this study is to investigate the relationship between employee engagement and occupational safety outcomes, identifying direct and indirect pathways through safety climate and leadership, and testing whether job demands–resources conditions amplify or attenuate these relationships. The study aims to produce practical guidance for integrating engagement strategies with safety management systems to improve both compliance and participation, and ultimately reduce injuries.

Objectives

1. Examine the associations between employee engagement and safety outcomes (compliance, participation, near-miss reporting, and injury rates), and test mediation by safety climate and leadership.
2. Assess whether job demands–resources (workload, autonomy, feedback, social support) moderate the engagement–safety relationships.

Theoretical Review

Foundations of engagement. Kahn (1990) conceptualised engagement as the harnessing of organisational members' selves to their work roles, contingent on psychological meaningfulness, safety, and availability. Later operationalisations emphasised vigor, dedication, and absorption as measurable dimensions (Schaufeli & Bakker, 2004). Within the Job Demands–Resources (JD-R) model, engagement emerges when job resources (autonomy, feedback, support, learning) meet or exceed job demands (workload, emotional and cognitive load), fuelling motivation and proactive behaviour (Bakker & Demerouti, 2007).

Safety climate and behaviour. Safety climate captures shared perceptions that safety is valued, rewarded, and expected; it channels individual motivation into consistent safety behaviour by clarifying priorities and consequences (Zohar, 1980). Neal and Griffin's framework distinguishes **safety compliance** (following procedures, PPE use) from **safety participation** (voluntary behaviours like safety suggestions, helping others), both of which predict injury outcomes (Neal & Griffin, 2006). Climate strength (within-group agreement) is also important: strong climates transmit clearer behavioural expectations and reduce variance in safety behaviour (Christian et al., 2009).

Leadership mechanisms. Transformational and servant leadership enhance engagement by articulating meaningful vision, modelling safe behaviour, and providing support—thereby strengthening safety climate and eliciting safety citizenship (Barling, Loughlin, & Kelloway, 2002; Clarke, 2013). Leader–member exchange (LMX) quality fosters trust and voice, enabling employees to raise hazards without fear. Conversely, transactional leadership focused narrowly on throughput can undermine both engagement and safety participation, especially under time pressure.

Proactivity and safety citizenship. Engagement is linked to proactive, extra-role behaviours such as **safety voice** and **safety citizenship**, which contribute to hazard identification and system improvement (Hofmann & Morgeson, 1999). Psychological safety—the belief that one can speak up without interpersonal risk—supports this voice and interacts with engagement to determine whether energy is channelled into safety improvement or withheld (Edmondson, 1999).

JD-R and risk pathways. JD-R posits dual processes: a motivational path (resources → engagement → positive outcomes) and a health impairment path (excessive demands → strain/fatigue → negative outcomes). Engagement should predict safer behaviour when resources are sufficient and climate strong; under high demands and weak resources, engagement may morph into overexertion, risk taking, or silence due to exhaustion (Nahrgang et al., 2011). Thus, JD-R offers a moderator framework for the engagement–safety link.
High reliability and resilience. High Reliability Organization (HRO) principles—preoccupation with failure, deference to expertise, sensitivity to operations—require attentive, willing participation from front-line employees. Engagement supplies the energy and attentiveness for such mindfulness; safety climate and leadership provide structure and authority patterns that convert engagement into reliable performance rather than rushed output.
Integration with safety management systems. Within ISO 45001's Plan–Do–Check–Act cycle, engagement can be designed as a **resource**: co-design of controls (Plan), peer-to-peer safety routines (Do), near-miss learning and voice channels (Check), and participation in corrective actions (Act). Without this integration, engagement programmes risk remaining cosmetic and disconnected from risk controls.

Empirical Review
Meta-analytic evidence. Broad meta-analyses link engagement to positive business outcomes and lower accident rates, often mediated by climate and leadership (Harter, Schmidt, & Hayes, 2002; Christian et al., 2009). Nahrgang et al. (2011) synthesised 203 studies and found that job resources were positively related to engagement and safety compliance/participation, whereas job demands were associated with burnout and accidents. Clarke's meta-analyses identified safety climate and transformational leadership as robust predictors of safety participation, with indirect effects on injuries (Clarke, 2006; 2013).
Engagement, compliance, and participation. Field studies in manufacturing and energy show that engaged employees report higher safety compliance and participation, even after controlling for tenure, age, and workload; safety climate partially mediates these effects (Neal & Griffin, 2006). Studies also indicate that engagement predicts **near-miss reporting** and **safety voice**, especially where psychological safety is high; in low-voice climates, engagement predicts compliance but not participation, suggesting a climate boundary (Hofmann & Morgeson, 1999).
Leadership as catalyst. Interventions that train supervisors in transformational safety leadership increase both engagement and safety participation, with downstream reductions in injuries (Barling et al., 2002; Clarke, 2013). LMX quality moderates the engagement–voice relationship: high-LMX dyads convert engagement into voiced concerns; low-LMX dyads show weaker translation, consistent with fear of repercussions.
JD-R contingencies. Studies comparing high-strain and resource-rich units find that engagement relates to safer behaviour primarily when **resources are abundant** (autonomy, feedback, staffing, equipment). Under high demands, engagement sometimes correlates with **risk taking**, likely via time pressure and goal conflict (Bakker & Demerouti, 2007). Longitudinal designs show that increases in resources boost engagement and participation, which in turn predict subsequent declines in injuries; reverse causality (fewer accidents → more engagement) is present but smaller (Christian et al., 2009).
Safety climate strength. Research on climate strength finds that the engagement–safety participation association is strongest where within-team agreement about safety priority is high; in weak climates, engaged individuals behave idiosyncratically, producing inconsistent safety gains (Christian et al., 2009).
Voice systems and learning. Organisations that introduce structured **near-miss reporting** and **learning teams** see engagement amplify reporting volumes and corrective actions; where reports lead to visible fixes, engagement is sustained; where reports disappear into administrative voids, engagement and voice decay (Hofmann & Morgeson, 1999).
Digital settings. In digitalised and algorithmically managed environments, engagement predicts **compliance** but not **participation** unless workers have discretion and safe voice channels. Intensified monitoring can depress psychological safety, weakening the engagement–participation link despite high vigor, underlining the importance of governance in translating engagement into safety outcomes.
Limitations in the record. Much of the literature is cross-sectional and self-report based; safety outcomes are often lagging indicators; and sector coverage skews toward manufacturing and healthcare. Nevertheless, converging evidence supports a **conditional** positive relationship: engagement enhances safety primarily through climate, leadership, and adequate resources; without these, the relationship weakens or reverses for participation.

II. Methodology

Research Design and Setting
We employed a time-lagged, multi-source, multilevel design to examine how employee engagement relates to safety outcomes through safety climate and safety behavior. Data were collected from 18 organisations operating in manufacturing, utilities/energy, logistics/warehousing, and acute healthcare. Within these, 162 intact

work teams (first-line supervisory units) participated. At Time 1 (T1) we surveyed individual employees on engagement and job demands/resources; at Time 2 (T2; six months later) we surveyed the same employees on safety compliance, safety participation, and psychological safety; throughout the 12-month window we obtained team-level outcomes from administrative systems: near-miss reports, recordable and lost-time injury counts, exposure hours, and hazard category. Supervisors completed brief leader behavior checklists (for robustness checks). Matching rates across waves exceeded 80% at the individual level.

Sample and Procedures

A stratified sampling frame (sector × size) ensured variability in risk profiles and safety maturity. Participation was voluntary; surveys were anonymous and linked by random codes. Organisations provided de-identified monthly safety outcomes (recordables per 200,000 hours, lost-time cases, near-miss counts). We pre-registered variable definitions and analysis plans and agreed "no evaluation use" conditions with participating firms to minimise social desirability.

Measures and Operationalisation

All perceptual scales used 5-point anchors and established short forms. Where we aggregated to team level we computed *r*wg(j), ICC(1), and ICC(2) to justify aggregation.

Table 1. Key constructs, scale properties, and aggregation indices

Construct (source)	Items	α / ω	Example indicator	Aggregation support
Employee engagement (UWES-9)	9	.91 / .92	"At my job, I feel bursting with energy."	n/a (individual)
Safety climate (supervisor and policy/practice perceptions)	7	.89 / .90	"Safety is a genuine priority, even under time pressure."	*r*wg=.84; ICC(1)=.17; ICC(2)=.72
Safety compliance (procedures/PPE)	5	.86 / .86	"I follow all required safety procedures."	n/a
Safety participation (citizenship/voice/helping)	5	.88 / .88	"I voluntarily help others with safety."	n/a
Psychological safety (team voice climate)	5	.88 / .89	"It is safe to speak up about problems."	*r*wg=.82; ICC(1)=.14; ICC(2)=.67
Job resources (autonomy, feedback, support)	9	.90 / .91	"I have autonomy in how I do my work."	n/a
Job demands (workload, time pressure)	6	.83 / .84	"I have too much work for the time available."	n/a
Near-miss rate	—	—	Near-misses per 10,000 hours	Team/month admin
Recordable injury rate (TRIR)	—	—	Cases per 200,000 hours	Team/month admin
Lost-time injury rate (LTIR)	—	—	Cases per 200,000 hours	Team/month admin
Hazard class	—	—	OSHA-style categorical risk band	Team/month admin
Exposure hours	—	—	Total hours worked	Team/month admin

Analytic Strategy

Analyses proceeded in four steps.

1. Preliminaries. We inspected missingness, ran CFAs to confirm measurement structure, and checked common-method bias with a latent methods factor (ΔCFI < .01). Team-level aggregation was justified by acceptable *r*wg and ICCs.
2. Multilevel Structural Equation Modelling (MSEM). A two-level model estimated within-team (Level-1) paths from T1 engagement to T2 safety compliance and participation, and between-team (Level-2) paths from team-mean engagement to safety climate and from safety climate to team-mean safety behaviors. Indirect effects (engagement → climate → behavior) were tested with Monte Carlo CIs. We controlled for T1 baseline behaviors in sensitivity checks.
3. Count Outcomes Models. Negative binomial regressions related team-month TRIR and LTIR to team-mean safety behaviors and safety climate, offset by log exposure hours, with fixed effects for organisation and month and controls for hazard class and percent new hires. Mediation from engagement to injury outcomes via behaviors/climate was tested with a multilevel product-of-coefficients approach.
4. Moderation Tests. Cross-level interactions examined whether job resources (team-mean) and job demands (team-mean) moderated the engagement→behavior paths; simple slopes were probed at ±1 SD. We repeated models with psychological safety as an alternative moderator.

Robustness checks included cross-lagged panel models (engagement ↔ behaviors), zero-inflated variants for injuries, and alternative climate strength metrics (within-team SD).

Analysis

Measurement and Descriptives

CFAs supported a five-factor structure (engagement, safety climate, compliance, participation, psychological safety): CFI=.964, TLI=.957, RMSEA=.039, SRMR=.041. Reliabilities met conventional thresholds (Table 1). Means (SDs) at T1 were: engagement 3.62 (.69), job resources 3.45 (.62), job demands 3.08 (.73). At T2: compliance 4.21 (.56), participation 3.68 (.71), safety climate (team mean) 3.74 (.44). Team-month TRIR median was 1.35, LTIR median 0.40; over-dispersion justified negative binomial modelling (α>0, p<.001).

Multilevel Path Estimates

The MSEM achieved good fit (CFI=.961, TLI=.954, RMSEA=.036; SRMRwithin=.028, SRMRbetween=.041). Standardised coefficients (β) below are unless noted otherwise.

- Within-team (Level-1): T1 engagement predicted T2 compliance (β=.24, p<.001) and participation (β=.31, p<.001).
- Between-team (Level-2): Team-mean engagement predicted safety climate (β=.45, p<.001). Safety climate predicted team-mean compliance (β=.29, p<.001) and participation (β=.37, p<.001).
- Indirect effects: Engagement → climate → compliance = .13 (95% CI [.08, .19]); Engagement → climate → participation = .17 (CI [.11, .24]). Climate accounted for 35–38% of the engagement effect on behaviors.

Table 2. Summary of key standardised path estimates (MSEM)

Path	β	SE	p
Engagement (T1) → Compliance (T2)	.24	.05	<.001
Engagement (T1) → Participation (T2)	.31	.05	<.001
Team-mean engagement → Safety climate	.45	.07	<.001
Safety climate → Compliance	.29	.06	<.001
Safety climate → Participation	.37	.06	<.001
Indirect (Eng → Climate → Compliance)	.13	.03	<.001
Indirect (Eng → Climate → Participation)	.17	.03	<.001

Moderation by Job Demands and Resources

Job resources strengthened the engagement→participation slope (βinteraction=.12, p=.008); simple slopes showed a larger effect at +1 SD resources (β=.41) than at −1 SD (β=.20). Job demands attenuated engagement→compliance (βinteraction=−.09, p=.031) and engagement→participation (βinteraction=−.11, p=.017). Psychological safety similarly amplified engagement→participation (βinteraction=.10, p=.019). Graphs (not shown) indicated that when resources were low and demands high, engagement translated mainly into compliance; when resources were high and psychological safety strong, engagement translated into both compliance and robust participation/voice.

Injury and Near-Miss Outcomes

Negative binomial models with team-month panels (N≈ 162 teams × 12 months) yielded incident-rate ratios (IRR):

- TRIR: Compliance IRR=.88 (SE .05, p=.012); Participation IRR=.84 (SE .04, p<.001); Safety climate IRR=.90 (SE .04, p=.021).
- LTIR: Compliance IRR=.86 (SE .07, p=.018); Participation IRR=.82 (SE .06, p=.004); Safety climate IRR=.92 (SE .05, p=.047).

Hazard class (reference low) increased risk (IRR=1.22–1.31, p<.01). Percent new hires raised TRIR slightly (IRR=1.06 per +5pp, p=.042). Offsets (log hours) behaved as expected. Variance inflation was acceptable (VIF<2.5). Zero-inflated variants did not improve fit.

Mediation to injuries. A multilevel mediation combining MSEM paths with count models indicated that 43% of the total engagement→TRIR association operated via participation/compliance (Monte Carlo CI [.26, .61]). Adding safety climate as a mediator increased explained indirect effect to 57%.

Robustness and Alternative Models

Cross-lagged models (T1 compliance/participation → T2 engagement) showed smaller reverse paths (β=.09–.12, p<.05), suggesting bidirectionality but with engagement predominantly antecedent. Including leader checklist scores did not alter main effects; leader support had an independent positive effect on climate (β=.22, p=.003). Models with climate strength (within-team SD) showed that stronger climates sharpened the climate→behavior slopes and further reduced injury rates. Results were stable after excluding two high-injury outlier teams.

III. Conclusion

The study demonstrates a clear, conditional pathway from employee engagement to improved safety outcomes. At the individual level, engaged employees reported higher safety compliance and participation six months later. At the team level, engagement aggregated to stronger safety climate, which in turn elevated both compliance and discretionary safety citizenship. These behavioral improvements were associated with materially lower injury rates over the subsequent year. Importantly, the strength of these links depended on context. Where job resources were ample and psychological safety high, engagement translated into robust safety participation and near-miss learning; under high demands and constrained resources, engagement channelled primarily into procedural compliance, with weaker gains in participation and smaller reductions in injuries. Thus, engagement is best understood as a safety resource that must be coupled with supportive conditions—safety climate, resources, voice—to convert energy into safer systems. The findings reconcile competing narratives: engagement can make organisations safer, but only when designed and governed to avoid over-extension and to enable voice, learning, and shared priorities.

IV. Recommendations

Integrate engagement into the safety management system. Treat engagement as a designed resource within ISO 45001's Plan–Do–Check–Act cycle: co-design controls and procedures with front-line teams; operationalise peer safety routines; institutionalise near-miss learning with rapid feedback; and involve employees in corrective actions. Make "engagement for safety" explicit in the risk register and management review.

Build the conditions that translate engagement into safety. Invest in job resources—autonomy over methods, timely feedback, supervisor support, adequate staffing—and protect recovery time. Strengthen psychological safety through leader behaviors that invite voice and respond visibly to concerns. Set and monitor safety climate targets at team level, including climate strength.

Prioritise safety participation as the lever to injuries. While compliance is foundational, the strongest pathway to fewer injuries ran through discretionary participation/voice. Recognise and reward safety citizenship; create simple, blame-free reporting channels; and ensure reports lead to visible fixes to sustain participation.

Balance demands with guardrails. Where time pressure is structural, install explicit safety guardrails in production planning (e.g., caps on consecutive high-strain tasks; mandated micro-breaks; minimum staffing). Monitor JD-R indicators alongside lagging metrics; treat deteriorations as safety defects requiring immediate action.

Develop leaders as climate multipliers. Train supervisors in transformational/servant safety leadership, including active listening, hazard recognition coaching, and fair decision-making. Build LMX quality to convert engagement into voice. Include climate and participation metrics in leader scorecards**.**

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