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Research article

Presenteeism and Work Experience Associated with Occupational Accidents among Dump Truck Operators in the Mining Industry

Amarin Yudhana* and Maradu Hutasoit

Universitas STRADA Indonesia, East Java, Indonesia
*Corresponden Author: Amarin Yudhana (amarinyudhana@strada.ac.id)

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ABSTRACT

Background: Health-related work functioning may be relevant to the safety of mining haulage operations. This study examined the relationship of source-defined Stanford Presenteeism Scale categories and job tenure with reported occupational events among dump truck operators.

Methods: A cross-sectional study included 112 operators recruited by incidental sampling from a workforce of 155 at a mining services company in East Kalimantan, Indonesia. The source report used the six-item Stanford Presenteeism Scale (SPS-6) and a binary measure of occupational accidents during the previous 12 months. The score cut-off and event classification were incompletely documented. Available aggregate tables were used to verify Pearson chi-square tests and calculate crude prevalence ratios with approximate 95% confidence intervals.

Results: Forty-two operators (37.5%) reported an event. Events were reported by 41 of 49 operators (83.7%) in the source high SPS-6 category and 1 of 63 (1.6%) in the low category (crude prevalence ratio 52.71; approximate 95% CI 7.51–369.89; Pearson $p < .001$). Event proportions were 58.3%, 43.2% and 12.8% across the source new, intermediate and long tenure categories, respectively (Pearson $p < .001$). No adjusted estimates were available.

Conclusion: Source-defined SPS-6 categories and tenure were associated with reported events in this sample. The meaning and magnitude of the SPS-6 contrast require caution because scoring direction is unverified and the comparator contains one event. These findings do not establish that working while ill causes accidents or that a screening intervention prevents them.

INTRODUCTION

Haul-truck safety depends on the interaction between operators, equipment and the working environment. Analysis of fatal haul-truck accidents in the United States identified recurring failures across several parts of the system rather than a single explanation based on operator behavior (Bellanca et al., 2021). Spanish mining accident records also show that severity varies with worker, company and event characteristics, although determinants of severity among recorded accidents are not necessarily determinants of whether an operator experiences an event (Baraza et al., 2023).

Working while ill is commonly described as sickness presenteeism. It should be distinguished from the effect of health problems on work performance: a worker may attend despite illness while retaining substantial functional ability, whereas another may struggle to complete tasks. This distinction appears in foundational research on illness attendance and in the subsequent development of the presenteeism literature (Aronsson et al., 2000; Johns, 2010). The SPS-6 was developed to assess health-related

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performance and productivity, making its scoring and interpretation central to any analysis that uses it as an exposure (Koopman et al., 2002).

Attendance decisions are shaped by more than health status. A meta-analysis identified associations with job demands, constraints on absence, available resources and work attitudes (Miraglia & Johns, 2016). Research in a Swedish university workforce linked presenteeism with exhaustion and impaired performance, while a Korean working-conditions survey examined a broader set of correlates of absenteeism and presenteeism (Aboagye et al., 2019; Bae, 2021). These studies support examining organizational context, but they do not establish a specific accident mechanism in Indonesian mining.

Job tenure is another relevant consideration. An Italian longitudinal analysis examined injury risk in relation to tenure, previous experience and age, indicating that time in the current job and prior experience need to be distinguished (Bena et al., 2013). Studies of mining injuries in Kenya and underground coal mining in Pakistan further illustrate the relevance of workplace context and behavioral factors, although their operations and outcomes differ from mechanized haulage (Ajith et al., 2020; Ali & Pal, 2022).

This study describes reported occupational events among dump truck operators at one mining services company in East Kalimantan and examines their relationships with source-defined SPS-6 categories and job tenure. Sex, age and work motivation are secondary descriptive correlates. The purpose is exploratory: the available cross-sectional data do not establish temporal ordering or independent causal effects.

METHODS

Design setting and participants

The source manuscript describes a quantitative cross-sectional study at a coal-mining services company in East Kalimantan, Indonesia. The company reportedly operated 73 dump trucks and used pre-shift fitness-for-work checks. The study population comprised 155 operators, of whom 112 were recruited through incidental sampling. The supplied report does not state the data-collection dates, detailed eligibility criteria, number approached or reasons for nonparticipation. The ratio of participants to the workforce is therefore not interpreted as a verified response rate.

Reporting of participant selection, measurement and analytical decisions should be completed against the STROBE framework before submission (von Elm et al., 2007).

Measurements

The source manuscript identifies the SPS-6 as the instrument and divides respondents into low and high categories using the score distribution. It does not provide the administered language version, item coding, reverse scoring, cut-off, recall window or local reliability results. The terms low and high are retained only as source labels. They are not interpreted here as verified levels of illness attendance or impairment. The original scale concerns functioning despite health problems, and subsequent psychometric work has questioned the interpretation of a single combined score (Bezzina et al., 2023; Koopman et al., 2002).

The binary outcome was self-reported occurrence of at least one occupational accident during the preceding 12 months. However, the source also mentions near misses and property damage among event types without specifying whether they entered this endpoint. We therefore refer to reported occupational events while preserving the original counts. The distinction between injury accidents and other events, event severity and corroboration against company records cannot be determined from the supplied manuscript.

Sex, age group, job tenure and work motivation were also recorded. Tenure was classified as new, intermediate or long; the source describes the longest category as at least five years but does not supply all category boundaries. The instrument and cut-off for motivation are not provided. No distinct composite work-capacity score is reported, so demographic and occupational characteristics are not treated as a validated measure of work capacity.

Statistical analysis

Counts and percentages were checked against the supplied tables. Pearson chi-square tests without continuity correction were independently recomputed for the SPS-6 by event table and the tenure by event table. All expected counts in these two tables exceeded five. A two-sided Fisher exact test was

also calculated for the SPS-6 table as a sensitivity check because one observed cell contained only one event. Expected and observed counts serve different roles in judging test assumptions (Kim, 2017).

Crude prevalence ratios (PRs) compare the proportion reporting an event across source categories. Prevalence ratios were used instead of interpreting odds ratios as risk ratios, since the outcome was common and the design was cross-sectional (Barros & Hirakata, 2003). Approximate 95% confidence intervals were calculated as $\exp[\ln(PR) \pm 1.96 \times SE]$, with $SE = \sqrt{(1/a - 1/n_1 + 1/c - 1/n_0)}$, where a and c are event counts and n_1 and n_0 the group totals. These aggregate calculations are additions in this revision, not newly collected observations or adjusted participant-level analyses. The interval for the SPS-6 contrast is especially approximate because the reference group has one event.

The source p values for sex, age and motivation are retained as unverified because their contingency tables were not supplied. No multivariable model, missing-data analysis or independent predictor claim is presented. Analyses are exploratory and no multiplicity adjustment was applied. Interpretation considers measurement, effect size and precision alongside p values (Greenland et al., 2016).

Ethical Clearance

Participants were informed about the study purpose and procedures and provided written informed consent. Participation was voluntary, and the authors report that anonymity, privacy and confidentiality were protected. The ethics committee name, approval or exemption identifier and date were not provided in the supplied manuscript and must be confirmed from the original decision before submission.

RESULTS

The sample comprised 112 operators. Ninety-four were male (83.9%) and 86 were aged 31–49 years (76.8%). Thirty-nine belonged to the longest tenure category (34.8%). High motivation was reported for 108 participants (96.4%), leaving only four outside that category. Forty-nine operators (43.8%) were assigned to the source high SPS-6 category, and 42 (37.5%) reported at least one event (Table 1).

Table 1 Participant characteristics

Characteristic	Source category	n (%)
Sex	Male	94 (83.9)
Age	31–49 years	86 (76.8)
Job tenure	New	36 (32.1)
Job tenure	Intermediate	37 (33.0)
Job tenure	Long	39 (34.8)
Work motivation	High	108 (96.4)
SPS-6 category	Low	63 (56.3)
SPS-6 category	High	49 (43.8)
Reported event	Yes	42 (37.5)
Reported event	No	70 (62.5)

Note. N = 112. Selected categories reproduce the supplied manuscript; other sex and age categories were not detailed. Tenure thresholds and SPS-6 coding require confirmation. Percentages may not sum to 100 because of rounding. Source: supplied manuscript, Table 1.

The proportion reporting an event was 83.7% in the source high SPS-6 category and 1.6% in the low category. The crude PR was 52.71, but its approximate confidence interval was wide (7.51–369.89). Pearson $\chi^2(1) = 79.241$, $p < .001$; the two-sided Fisher test also gave $p < .001$. Statistical separation of the groups does not resolve the uncertainty about what their score labels represent (Table 2).

Table 2 Source SPS6 categories and reported events

Category	Event n (%)	No event n (%)	Total	Crude PR (95% CI)
Low	1 (1.6)	62 (98.4)	63	1.00 Reference
High	41 (83.7)	8 (16.3)	49	52.71 (7.51–369.89)

Note. Percentages are within categories. Counts are from the supplied manuscript, Table 2. PR and approximate log-Wald interval were calculated from those counts during revision. The sparse comparator produces substantial uncertainty; verify the underlying data and scoring before interpreting the contrast.

Event proportions declined across the reported tenure groups: 21/36 (58.3%) in the new group, 16/37 (43.2%) in the intermediate group and 5/39 (12.8%) in the long group. The overall Pearson test was $\chi^2(2)$

= 17.322, p < .001. Relative to the long group, the crude PRs were 4.55 for the new group and 3.37 for the intermediate group (Table 3).

Table 3 Source tenure groups and reported events

Tenure	Event n (%)	No event n (%)	Total	Crude PR (95% CI)
New	21 (58.3)	15 (41.7)	36	4.55 (1.92–10.79)
Intermediate	16 (43.2)	21 (56.8)	37	3.37 (1.37–8.28)
Long	5 (12.8)	34 (87.2)	39	1.00 Reference

Note. Percentages are within tenure groups. Counts are from the supplied manuscript, Table 3; PRs and approximate log-Wald intervals were calculated during revision. These are unadjusted comparisons, not estimates of a causal protective effect of tenure.

The source reports p = .232 for sex, p = .334 for age and p = .115 for motivation. These values could not be independently checked without the relevant cross-tabulations. The very small group outside the high-motivation category makes the choice of test particularly important: if all 112 observations were included, its expected event count would be 4 × 42/112 = 1.5. An exact test should therefore be considered when the original table is available (Kim, 2017).

DISCUSSION

Interpretation of the main finding

The principal observation is the marked difference in reported events between the two source SPS-6 categories. It merits investigation, but it is not yet evidence that greater sickness attendance caused accidents. The high label is not sufficiently documented to identify either worse impairment or more frequent work attendance while ill. In the conventional interpretation of the SPS-6, some items concern the ability to complete work despite a health problem; the original development study and later psychometric analysis make clear why the scoring key must be examined before assigning a behavioral meaning to a total score (Bezzina et al., 2023; Koopman et al., 2002).

The association is also unusually sensitive to the reference group, in which only one operator reported an event. The approximate interval extends from about 8 to 370 on the PR scale. This does not invalidate the displayed counts, but it shows how poorly the magnitude is determined. A small p value can coexist with substantial uncertainty and does not protect against coding errors, selection bias or an ambiguous construct (Greenland et al., 2016). The first analytical priority is therefore an audit of the original responses, category assignment and outcome coding.

Illness attendance and reduced functioning remain plausible concerns in safety-critical work, but the external evidence addresses different outcomes. A Swedish prospective study linked sickness presenteeism with later sickness absence, and a review of longitudinal studies examined subsequent health and wellbeing (Bergström et al., 2009; Skagen & Collins, 2016). Neither establishes the causal sequence in this mining sample. Here, an event in the previous year could have preceded the reported health limitation, making reverse causation a credible alternative explanation.

Job tenure and the conditions of work

The tenure pattern is consistent with the possibility that operators need time to become familiar with local routes, equipment and procedures. Bena et al. (2013) examined tenure separately from prior experience, supporting that distinction in future work at this site. The present categories, however, lack complete boundaries and do not distinguish experience with the current employer from total haul-truck experience. They therefore cannot be treated as a direct measure of skill or competence.

Other explanations remain possible. Newly assigned operators may receive different routes, shifts or vehicles, while workers who remain longer may be a selected group who have tolerated the job or avoided serious injury. The available tables cannot separate these pathways. Research in artisanal mining and underground coal mining also places injuries within specific management and behavioral contexts; its findings should inform the choice of future covariates rather than be imported as effect estimates for this workforce (Ajith et al., 2020; Ali & Pal, 2022).

The absence of a small reported p value for sex, age or motivation should not be read as proof that these factors are irrelevant. Motivation has little variation in this sample, and the other underlying tables are unavailable. Spanish mining data associated several worker and workplace characteristics with accident

severity, but that study analyzed severity among recorded accidents rather than the binary occurrence endpoint used here (Baraza et al., 2023). The distinction limits direct comparison.

Implications for occupational health and haulage safety

A useful response would examine the conditions under which operators disclose health problems and receive assistance. International research links illness attendance with absence constraints, demands and resources, and occupational surveys show that presenteeism is embedded in work circumstances rather than being solely an individual choice (Bae, 2021; Miraglia & Johns, 2016). Confidential access to occupational health advice and clear procedures for temporary work modification are reasonable subjects for local evaluation. Their effectiveness was not tested in this study.

Fatigue requires a separate assessment. It may overlap with ill health but was not measured by the reported categories. Mining-specific literature describes the influence of schedules, monotonous tasks, environmental conditions and remote work on fatigue (Bauerle et al., 2022). Future investigation should record these exposures explicitly instead of using SPS-6 categories as a proxy for alertness. The distinction also matters clinically: a work-productivity score alone does not establish whether an operator is fit for a particular safety-critical task.

Health support should sit alongside engineering and organizational controls. Haulage accident analysis points to interacting hazards and failed barriers, supporting attention to road conditions, visibility, maintenance, traffic separation and supervision (Bellanca et al., 2021). Mentoring for newly assigned operators may be worth evaluating, but tenure should not substitute for demonstrated competence. Any new screening or training program should be assessed prospectively using clearly defined incidents, exposure hours and measures of unintended effects on reporting.

Limitations and future research

The single-site, incidental sample limits generalizability. Operators absent through illness or injury may have been less available for recruitment. Self-reported functioning and event history are vulnerable to recall and reporting bias, and collecting both through the same survey may introduce shared measurement error. The uncertain inclusion of near misses and property damage prevents injury-specific interpretation. Missing study dates and the unreported SPS-6 recall window further limit assessment of temporal order.

Dichotomization can discard information and make findings dependent on the chosen threshold (Altman & Royston, 2006). After the administered version and scoring are verified, future analyses should examine the original score distribution and relevant SPS-6 components rather than automatically repeat the high–low split (Bezzina et al., 2023). Any alternative threshold should be justified independently of the association it produces.

Participant-level data are required to assess confounding by age, prior experience, shift schedule, health status and task exposure. Prevalence-ratio models may be appropriate, but the sparse comparator limits model stability and the scope for adjustment (Barros & Hirakata, 2003). Prospective work should assess health before subsequent events, record exposure hours and distinguish injury, damage and near-miss outcomes. Recruitment, missing data and analytical decisions should be reported transparently (von Elm et al., 2007).

CONCLUSION

Among 112 participating dump truck operators, source-defined SPS-6 categories and job tenure were associated with self-reported occupational events. Interpretation of the SPS-6 contrast remains conditional on verification of scoring and category direction, and its magnitude is imprecise because the low category contains one event. The tenure pattern is unadjusted. The findings support further investigation of worker health and local work conditions, but they do not establish causal risk factors or demonstrate the effectiveness of a preventive intervention.

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