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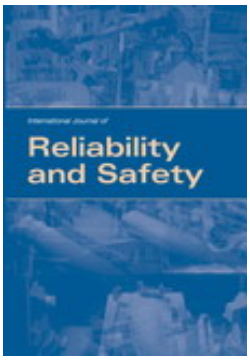

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Key factors of near miss reporting behaviour at work and the interaction of safety climate: a review based on reciprocal safety model

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Key factors of near miss reporting behaviour at work and the interaction of safety climate: a review based on reciprocal safety model

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Abstract: Near misses share with safety accidents their origin but with no or reduced impact, thus providing organisations with the prediction of workplace accidents without experiencing actual cost and harmful consequences. Despite the effort to make near miss reporting a mandatory requirement, the issue of near miss under-reporting remains. Extant literature examines the key factors of near miss reporting behaviour as independent determinants, without considering the interaction of these factors and, more importantly, the interaction of the reporting behaviour and the safety climate at work. In the reciprocal safety culture model, safety behaviour is found to reciprocate with personal and organisational factors. This paper examines the key factors of near miss reporting and its interaction with safety climate through study review, and discusses the reciprocal relationship of near miss reporting behaviour. The study findings will serve as reference for safety researchers and practitioners for effective near miss management system and training development.

Keywords: near miss reporting; near miss management; workplace accidents prevention; safety behaviour; reciprocal safety culture; organisational safety climate; psychological safety climate.

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1 Introduction

The concept of near miss occurrences as accident precursors was introduced in Heinrich (1931) by the famous safety engineer Herbert William Heinrich through his theory of the safety triangle. Since then, numerous interpretations have been given to define the concept of near misses in the workplace safety context. Near misses are commonly described based on three key aspects of the event: the occurrences, the potential consequences and the contribution of such events or incidents. Near misses, sometimes known as near hits or close calls (Williamsen, 2013; Zhou et al., 2019; Mckinnon, 2012), are unplanned, unforeseen or unusual occurrences (Zhou et al., 2019; Gnoni et al., 2020; Zhang et al., 2016), with potential serious and negative consequences (Geoffrey, 1999; Phimister, 2003; Zhou et al., 2019; Hasansphaic et al., 2020, 2022), where the consequences have been interrupted or reduced by planned intervention, by luck or fortune or by any random event (Zhou et al., 2019; Hasansphaic et al., 2020; Gnoni et al., 2020). It is a warning signal, a lesson for organisations to learn and take proactive safety control for workplace accident prevention (Zhou et al., 2019; Mckinnon, 2012, Hasansphaic et al., 2022; Yang et al., 2014; Andriulo and Gnoni, 2014; Hasansphaic et al., 2020; Lander et al., 2011). The definition of near miss may vary across organisations (Haas and Yorio, 2019). An organisation with a formal safety management system may further elaborate the near miss and include the provision of relevant near miss examples to guide their workers through the near miss identification and reporting process (Haas et al., 2020). Some organisations restrict near misses to events with a potential harmful impact, including property damage or product loss. Others may also include potential hazardous situations such as unsafe behaviour and unsafe conditions that contribute to undesired or harmful consequences (Phimister, 2003; Gnoni et al., 2020).

2 The importance of near miss management

2.1 Near misses as safety accident precursors

The growing number of workplace safety accidents has become a global concern for the workforce. According to the International Labour Organisation (ILO), it has been estimated that 2.3 million fatalities occur every year due to work-related accidents and diseases. Based on the statistics released by the ILO, work-related accidents occurred at an alarming frequency, where once every 15 seconds there were 151 workers got involved in work-related safety accidents (International Labor Organisation, 2013). We are often shocked and overwhelmed by these alarming safety accident statistics (Moran and McSween, 2017; Dhanabal et al., 2016; Noor Afifah et al., 2016). However, the number of near misses, which are proven to share with accidents their origin (Leo et al., 2023), has not been given much attention until now. In the traditional design of the safety triangle, Herbert William Heinrich indicated that for every 300 near misses, there were 29 minor injuries and 1 major injury (Moran and McSween, 2017). This implies that for every single major injury to occur, there were indeed 300 near misses that served as a warning sign or safety precursor to alert the relevant parties to take necessary safety recoveries or preventive actions before catastrophic accidents might occur. The

effectiveness of near miss management in reducing or preventing safety accidents has been found in various high-risk industry sectors such as mining, construction, aviation and petrochemicals (Paul and Stephen, 2000; Yoriom and Moore, 2018; Zhou et al., 2019). This proactive safety effort needs to be promoted across all working sectors, including manufacturing and process industries, in order to mitigate the growing number of work-related safety accidents.

2.2 Near miss management for safety learning

Workplace safety accidents could be tragedies that injured or took away lives of workers. It is also a cost-producing incident that would burden the company's finances due to safety costs (Haas and Yorio, 2019). The expenses incurred by workplace safety accidents include costs of lost working time, costs of loss and/or damage to work equipment, costs of consumption of consumables, fines and penalties, compensation for workers' injuries or deaths, costs necessary for taking safety measures and many other hidden costs resulting from operation interruption (Buica et al., 2016). Near misses share with accidents their origin but with no or reduced impact, thus providing organisations the prediction of harmful accidents that could happen without experiencing the actual cost of accidents (Haas et al., 2020). Through recognising, reporting, investigating and providing feedback on countermeasures for near misses, both organisations and workers will be able to learn from the fundamental causes and errors in the system's functioning, thus improving safety performance, including human-machine interaction, to create a safer working condition and work environment (Geoffrey et al., 1999; Haas and Yorio, 2019). According to Geoffrey et al. (1999), the only purpose of the near miss management system should be to learn at an organisational level from the reported near misses. Except for cases of deliberate rule breaking or sabotage, the reporting of near misses should never lead to culture of blame among workers. Learning from near-misses is always far less costly than learning from destructive accidents. It is therefore a critical learning component of the organisation safety management system (Haas and Yorio, 2019). Focusing on near miss management can be a positive, knowledge-building way to increase safety learning in the organisation. Neglecting near misses can lead to serious negative safety outcomes. When near misses go unreported and the cases of minor injuries are not recorded, if the underlying causes attributed to these events are never addressed and resolved, they accumulate until a significant and catastrophic disaster occurs (Galloway, 2019). Furthermore, when near miss reporting is not practised or discouraged, workers fail to see the threat arising from near miss occurrences, and the chances of negative safety outcomes among workers will increase, as workers tend to build up a sense of resilience and become more tolerant of such risks in the future (Haas and Yorio, 2019).

2.3 Near miss reporting for obligatory requirements compliance

Near miss management has been proven to be an effective mechanism in safety management system. Several authorities or international associations in high-risk sectors such as nuclear power plants, aviation, maritime, mining and healthcare have made near miss reporting a mandatory practice among their members (Storgard et al., 2012; Paul and Stephen, 2000; Haas et al., 2020; Haas and Yorio, 2019). For the shipping industry,

the International Maritime Organisation (IMO) has made near miss reporting an obligation of its members to promote learning from incidents for safety performance improvement (Storgard et al., 2012). The Mine Safety and Health Administration (MSHA), requires near miss events to be reported on a quarterly basis among the mining industries (Haas et al., 2020). Also in the USA, the near miss reporting requirement is integrated into OSHA's process safety standard for the hazardous chemical processing industry (Haas and Yorio, 2019). However, despite the mandatory effort to promote near miss reporting and management, workers' participation in this proactive safety measure, particularly in the reporting stage, is found to be inadequate and unsatisfactory. Studies in several sectors, including healthcare, maritime shipping and the construction sector, have highlighted the issues of near miss under-reporting (Zhou et al., 2019: Hasanspahic et al., 2020, 2022). Considering that near misses and safety accidents appear to share similar causal factors and near misses tend to occur with greater frequency (Lander et al., 2011) it is crucial to pay attention and analyse the barriers in the near-miss management system for safety improvement.

2.4 The research objective

Numerous studies have been conducted to identify and analyse the contributing factors to near miss reporting behaviour, however, most extant literature only examined these factors as independent determinants without considering the interaction of these factors and, more importantly the interaction of the reporting behaviour and the safety climate at work. Workplace is a complex system that consists of multiple factors at the individual, group and organisational levels. These factors interact with each other to determine the workers' behaviour and performance. Workplace safety climate can be conceptualised at two levels: the organisational safety climate at a high level of shared perception construct and the psychological safety climate at a non-aggregated individual level. Workers' willingness to participate in a near miss management system can be determined by both personal factors at the individual level and social environmental factors at the group or organisation level (Clarke, 2010; Zohar and Luria, 2005). According to the behavioural psychologist Albert Bandura in his theory of reciprocal determinism, a person's behaviour both influences and is influenced by personal factors and the social environment. Each factor affects the others, and vice versa (Bandura, 1978) (see Figure 1). This reciprocal model was then adapted by Cooper in his reciprocal safety culture model to further explain the interactions between safety behaviour, personal factors and organisational factors (Cooper, 1997) (see Figure 2).

Thus, this paper aims to examine the key factors of near miss reporting at individual, group and organisation levels through studies review, and discuss the reciprocal relationship of near miss reporting behaviour with the safety climate. This paper will serve as a reference for safety researchers and practitioners to recognise the contributing factors of near miss reporting behaviour and take into consideration for effective near miss management system development, as well as to improve near miss recognition training by outlining the critical barriers.

Figure 1 Albert Bandura (1978) reciprocal determinism model

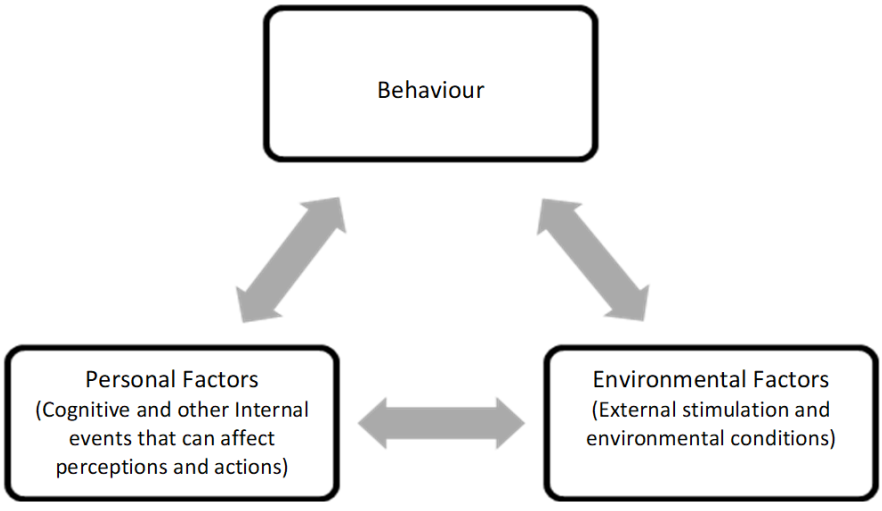
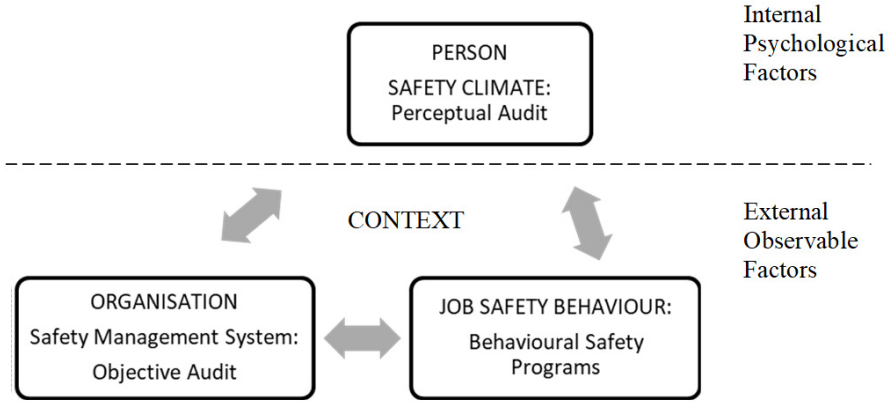


Figure 2 Cooper (1997) reciprocal safety culture model

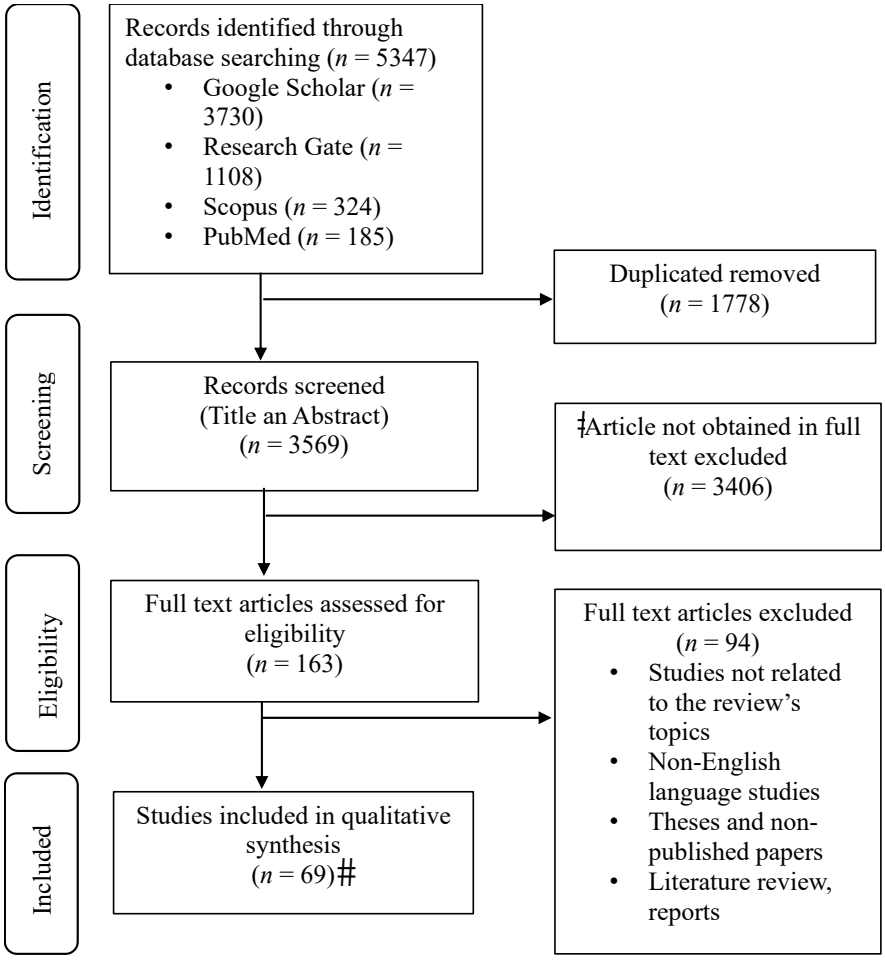


3 Review methodology

This review followed the guidelines of the PRISMA Statement for article selection process: identification, screening, eligibility and inclusion, as shown in Figure 3 (Pedrosa et al., 2022). In the identification phase, articles for review were selected through online searching of four electronic databases (Google Scholar, Research Gate, Scopus and PubMed). The predetermined keyword(s) and their combination included 'near miss', 'near miss incident', 'near miss event', 'near miss occurrence', 'near miss case', 'near miss management system', 'near miss reporting', 'near hits', 'close call', 'workplace safety incident', 'workplace safety reporting', 'workplace safety accident precursor', 'workers safety voice', 'safety climate', 'organisational safety climate', 'psychological

safety climate', 'reciprocal safety behaviour', 'near miss reporting barrier', 'near miss under-reporting', etc. Boolean functions 'And', 'Or' and 'Not', and their combinations were used for refining the output. Non-indexed journals were not considered for the selection.

Figure 3 Flow diagram of article selection process



At the initial screening stage, 1778 duplicates were identified and removed; 3569 articles remained for further screening. A priori inclusion criteria included work-related publications, studies assessing near miss reporting in the workplace, those focusing on worker safety reporting behaviour, and articles written in English. In contrast, the exclusion criteria were mainly non-workplace-based and non-safety related studies. Finally, 69 of the most relevant studies are included in the current review.

4 Results

The research focused on publications in the past two decades, from the year 2000 to 2022 for the study review. Studies related to workplace near miss incidents were found across various sectors. Among the selected studies, construction (Lu et al., 2019; Tietze et al., 2015; Whiteoak and Appleby, 2019; Yang et al., 2014; Zhou et al., 2019), maritime or shipping (Hasansphaic et al., 2020; Lappalainen et al., 2011; Storgard et al., 2012) and health care (Chegini et al., 2020; Singal et al., 2018) were the most popular sectors for near miss management system analysis and study. Other sectors involved include the chemical and petrochemical industries, manufacturing industries, pulp and paper mills, automotive, mining, energy, oil and gas, agriculture, nuclear and aviation (Andriulo and Gnoni, 2014; Haas et al., 2020; Mckinnon, 2012; Mbuvi et al., 2015; Paul and Stephen, 2000). Safety researchers and practitioners conducted research in various phases to understand the near miss management system from different perspectives. Studies selected for review comprise research that examines the design and development of a system framework (Phimister et al., 2003; Paul and Stephen, 2000; Storgard et al., 2012; Zhou et al., 2019), testing the effectiveness of system adoption and implementation (Andriulo and Gnoni, 2014; Clancy et al., 2011), evaluating the value and benefits of near miss data management in workplace safety outcomes and performance (Gnoni et al., 2020; Lander et al, 2011), and studies on the near miss reporting rate, including the factors and barriers that influence near miss recognition and reporting among workers (Hasansphaic et al., 2020; Lappalainen et al., 2011; Mbuvi et al., 2015). Through the study review, four key factors at the individual, group and organisational level have been confirmed to have a significant influence on workers near miss reporting behaviour. Besides, key factors identified were found to interact with different levels of safety climate in the workplace to determine the workers' safety behaviour.

5 Discussion

5.1 Workers' safety knowledge

Individuals' safety knowledge and their capability to anticipate the potential harmful impact are the key factors to successful near miss identification. Unlike accidents, where the obvious harmful consequences such as injury, loss of life or property damage will trigger the reporting process, near miss events often come with no or insignificant impact (Phimister et al., 2003; Hasansphaic et al., 2020; Andriulo and Gnoni, 2014), making it difficult for workers to recognise the reportable near misses in day-to-day operations (Geoffrey, 1999; Phimister et al., 2003; Singal et al., 2018; Hasansphaic et al., 2020). In the study of Phimister et al. (2003), 68% of the hourly workers expressed confusion as to what constitutes a near miss, believed that near misses must have contributed to significant process upset, and they will be able to recognise when they 'see' the consequences. However, near miss incidents often leave no or an unnoticeable trace for workers to make judgements about the potential harmful consequences and whether they are reportable or not, and this judgement is varied across individuals depending on their level of safety knowledge (Phimister et al., 2003, Lappalainen et al., 2011; Geoffrey, 1999; Singal et al., 2018; Mckinnon, 2012; Duryan et al., 2020) and working experiences (Geoffrey, 1999; Hasansphaic et al., 2020; Cecchini et al., 2018). Safety knowledge can

be classified into two dimensions: explicit and implicit knowledge (Huie et al., 2020; Ni et al., 2020; Olak et al., 2021). In addition to the formal and documented explicit knowledge that is often presented through safety procedures, work instructions and reports, the implicit knowledge in the form of training or mentoring processes regarding the safety value can be very useful in helping the workers, especially the newcomers, to avoid workplace accidents, particularly in regards to pioneering work where near miss recognition itself is often a challenging task and requires more work-related practical experience (Geoffrey, 1999; Tietze et al., 2015; Choudhury and Das, 2021).

Workers' voices can be an effective source to harvest work-related safety information, particularly the safety voice from front-line workers, given their ongoing position and direct engagement in the work process (Andiri et al., 2021; Haas and Yorio, 2019). Unfortunately, inadequate knowledge to define near misses impeded the reporting of potential hazards, organisations therefore lose precious feedback from workers and fail to prevent accidents proactively. A study involving seafarers in the shipping industry revealed that majority of the low-ranking crewmembers were unable to answer the near miss definition question correctly. The crewmembers lack of safety knowledge to identify near miss events, and their understanding of near misses confined to practical examples closely related to their job onboard the ship, which indicates they are not equipped with knowledge to recognise potential harmful events under different scenarios other than the practical example (Hasansphaic et al., 2020). This finding is aligned with Mbuvi et al. (2015), where a high response rate of 83.8% among workers in an Oil and Gas company indicated the lack of near miss management knowledge and skill training led to failure in identifying and reporting near misses among workers (Mbuvi et al., 2015). A similar issue was also detected in the healthcare industry, where a survey conducted among healthcare staff revealed that lack of knowledge was the most important barrier to patient safety event reporting. When asked to define clinical vignettes into sentinel events, adverse events and near misses, it was found that about half of the respondents were uncertain of what is considered a patient safety event. The respondents to the survey not only faced difficulties to defining near miss cases but were also unsure about what events should be reported. In the survey, as many as 58.1% of the respondents did not think the near miss cases identified were reportable. This finding suggested that even when a respondent correctly recognised a near miss event, the event was still more likely to go under-reported due to the personal knowledge gap (Singal et al., 2018). A clear understanding of near miss definition is therefore crucial to overcome the confusion and uncertainty among workers to identify and report near misses. According to the guideline published by the American Industrial Hygiene Association, the first step to promoting a near miss reporting program is to define what entails a near miss for the organisation (Schneider, 2017). Besides, routine safety briefings to refresh workers' safety knowledge and awareness have been found to effectively promote the near miss reporting rate. In the study of Haas et al. (2020), researchers from National Institute for Occupational Safety and Health (NIOSH) analysing hundreds of near miss reports from mining sites discovered that a pre-shift safety briefing to boost workers' safety knowledge has increased near miss reporting, particularly on incidents that align with topics discussed during the pre-shift safety briefing.

5.2 Workers' perceived risk

Another key factor influencing workers willingness to participate in near miss reporting is their perceived risk of reporting consequences, whether their reporting behaviour will be appreciated, devalued or even worse, punished or retaliated against (Williamsen, 2013; Singal et al., 2018; Svibovich, 2020; Probst and Estrada, 2010; Duryan et al., 2020). This perception is closely related to the psychological safety of workers in the workplace. Edmondson (2019), defines psychological safety as 'the belief that the work environment is safe for interpersonal risks, and that risky behaviours, like asking for help or admitting a failure, will not be punitive'. Fear of action's consequences is the largest barrier to the growth of psychological safety. It is also the main culprit behind workplace safety silence (Salas et al., 2016). According to Svibovich (2020), workers expressed fear of being judged or punished by superiors, fear of shame, embarrassment or guilt of accidentally offending another group member due to reporting a near miss, instead of fear of the harmful hazard exposure consequences of not reporting the near miss events they have encountered.

In the early section of discussions, safety knowledge has been identified as the critical factor for near miss identification and reporting. However, workers equipped with safety knowledge may somehow not be able to contribute what they know, when they fail to recognise the need for their knowledge to resolve problems at work. In fact, workers often decided to remain silent in fear of being wrong, or offending a leader or a colleague (Phimister et al., 2003; Singal et al., 2018; Mckinnon, 2012; Svibovich, 2020; Pacheco et al., 2015). Workers' fear of being punished by their superior for reporting an unsafe act or condition (Hasansphaic et al., 2020; Zhou et al., 2019; Webb et al., 1989; Chegini et al., 2020; Sinclair and Tetrick, 2004) or worry about losing the opportunity for better performance evaluation for making their superior unpleasant due to speaking up about the safety issue, which may be seen as accusing the superior of failure in providing a safe working environment to the workers (Svibovich, 2020; Probst and Estrada, 2010; Pacheco et al., 2015). In one study assessing workers' knowledge and attitudes towards reporting safety events, more than half of the respondents perceived reporting as an action that would threaten management autonomy or violate the organisational hierarchy (Singal et al., 2018). This finding is also supported by the study in Edmondson (2019), where 85% of respondents reported experiencing hesitation and refusing to raise a concern with their superior, despite believing the issue was important. Numerous studies of workplace incident reporting have shown that workers refuse to report safety incidents because they feel ashamed to speak out about the incident that was caused by their behaviour and that reporting such incidents will make others question their competency at work (Singal et al., 2018; Hasansphaic et al., 2020, 2022). Majority of workers perceived that reporting a near miss caused by an unsafe act was equivalent to bringing out their own or others' mistakes (Storgard et al., 2012). Workers may decide to remain silent if such incidents occur due to not following safety policies and procedures, particularly when the incident is minor and leaves no trace (Lander et al., 2011). In the study of Singal et al. (2018), 64.8% of the respondents revealed concern about reported medical errors being seen as a sign of incompetence. Interestingly, the study revealed that workers' willingness to engage in near miss reporting could be affected by nationality. The authors reported that some Asian nationalities are more concerned about their self-esteem, and it is important not to lose face by admitting for making mistake. In the study of Storgard et al. (2012), respondents admitted that sometimes the human mistake in a

near miss report will be diminished or attributed to technical error in order to maintain a good reputation and avoid being seen as incompetent at their work.

Besides, the pressure to maintain an accident-free record has also restricted workers' freedom to report near misses and led to a significant drop in reportable occurrences. Some organisations are ambitious about setting a workplace accident-free target for their safety management systems. This intention to quantify safety performances through the number of accidents rather than safety behaviours has discouraged workers from reporting near misses as they are afraid of breaking the company's accident-free record or being blamed for poor target achievement (Williamsen, 2013). Management priority on target achievement, either by rewards or punishment contingent upon safety outcomes rather than behaviours, has reduced the safety reporting rate. Furthermore, it was found that workers tend to 'downgrade' the degree of hazard or classification of incidents when reporting near miss cases, with the intention to reduce the impact level of incidents, despite being well educated and familiar with near miss classification (Probst and Estrada, 2010). The reduction in reporting numbers could be a sign of workplace safety silence, where workers decide to remain silent about the safety hazards or noncompliance and reduce the number of reports or not report at all in order to meet management goals (Williamsen, 2013, Paul and Stephen, 2000). Moreover, workers are also uncertain about their management's acceptance of the rise in near miss incidents. Some organisations manifest safety as the highest priority in their policy commitments but compromise safety during daily operations in order to meet operational demands. Such inconsistent practice sends a conflicting signal to the workers as to what their management really wanted to achieve. Workers thus have doubts about the relative importance of safety in comparison with other goals (Mckinnon, 2012; Salas et al., 2016). On the other hand, while rewarding the accident-free led to a reduction in incident reporting, relevant studies also discovered the problem of misleading data in providing recognition for the near miss reporting system (Hasanspahic et al., 2022; Mckinnon, 2012). The commitment to increase the number of near miss reports has created the risk of workers fabricating reports or reporting irrelevant incidents, which leads to a waste of resources such as time and manpower allocated to investigate and analyse the no-value added or non-significant hazards (Phimister et al., 2003; Hasanspahic et al., 2022).

5.3 Coworker's norms

In the workplace setting, workers often interact more frequently with their co-workers than with superiors or leaders. Coworker influence is found to be an important determinant of workers safety behaviour, including near miss reporting, worker safety voice and peer-to-peer safety communication (Lingard et al., 2019; Zhang et al., 2018; Guo et al., 2019; Xia et al., 2020; Probst and Estrada, 2010). The perceptions of group-level safety climate, sometimes known as coworkers' norms, emerge from coworker interaction among the proximate members. The study of Watson et al. (2005) revealed coworkers' safety norms predicted both worker risk behaviours and perceived work environmental safety. Supportive coworkers' norms can effectively reduce the rate of workplace injuries and accidents, as workers speak up and warn their coworkers about the hazards at work, reminding each other to comply with safety protection requirements such as the use of personal protective equipment (Ji et al., 2019). The mechanism of coworker norms is well explained by the social norms' theory, where people are highly influenced by what they think their peers are doing or thinking and then conform to what

they believe is the norm, or social expectation. The more proximal and similar it is between the group members, the stronger the shared perceptions will be (Choo et al., 2017; Singh and Verma, 2018; Purwanto, 2018).

One of the main reasons that individual behaviour and decisions are affected by group norms is the fear of negative interpersonal consequences for deviating from the group's shared perceptions (Probst and Estrada, 2010; Phimister et a., 2003; Mckinnon, 2012; Bridges, 2012). In a case study of the near miss reporting program in the water services department, workers perceived that reporting unsafe conditions or acts was criticising their coworkers, and this reporting action would lead to coworkers' retaliation (Nevitt, 2011). A site interview survey of 20 chemical industries and pharmaceutical facilities also reported coworkers as one of the potential recriminations for near miss reporting. Workers feel stress and psychological discomfort from being widely publicised as whistle blowers for near misses (Phimister et al., 2003). The study conducted by Mullen (2005) to assess perceived norms in manufacturing and service industries in Canada revealed that the willingness of workers to speak up about safety issues depends on their perceived probability of success and their perceived image risk. Workers are reluctant to speak out for safety when their coworkers perceive reporting action as an exaggerated reaction towards something that has obviously not caused any significant impact yet on their safety and health. This phenomenon is more salient in the work environment with a macho attitude (Williamsen, 2013; Mckinnon, 2012, Probst and Estrada, 2010). Coworkers often underestimate the impact of near misses and view them with humour instead of seeing the hazards. It will be embarrassing for the workers to stand up and make noise about something that everyone in the group basically accepted and treated as part and parcel of the job (Mckinnon, 2012). Moreover, it was found that some workers demonstrated a fatalistic attitude and believed injuries were a fact of life in certain lines of work (Webb et al., 1989; Chegini et al., 2020; Sinclair and Tetrick, 2004). The world's largest mine, Anglo American, when demand for zero fatalities or serious injury-free achievement was deemed unrealistic by the majority of the old guard members, as they believe serious injuries and deaths were considered as an inevitable hazard, part of mining's dangerous physical demands (Edmondson, 2019).

Coworkers who work together in the same environment are often exposed to similar safety hazards, the increase in safety communication among the proximate members improves the chance to detect and prevent workplace risks (Lingard et al., 2019). Frequent interactions about safety matters within a group therefore increase the safety awareness and promote the safety climate in an organisation (Probst and Estrada, 2010). However, workers are subjected to peer and subordinates' informal evaluation at the workplace, and taking initiative to raise questions, admit mistakes, offer ideas or criticise a plan could put their image at risk (Edmondson, 2019). Thus, workers are inclined to remain silent to prevent putting their coworkers into trouble or jeopardising their group safety performances (Mckinnon, 2012; Probst and Estrada, 2010).

5.4 Safety leadership – support and feedback

Management commitment to safety initiatives advocated through the company's vision and policies can be ambiguous and vague to the workers. These management values and beliefs need to be substantially demonstrated to their workers through the leadership's emphasis and actions in the day-to-day operations (Bridges, 2012; Williamsen, 2013). The physical visibility of leader efforts, such as the leader's support and encouragement

for safety engagement, together with feedback and recognition for safety efforts, were found to have a critical impact on workers participation in near miss reporting (Hasanspahic et al., 2022; Whiteoak and Appleby, 2019; Clarke, 1998; Probst et al., 2008; Zohar, 2003; Bridges, 2012; Salas et al., 2016; Duryan et al., 2020).

Near misses are valuable sources for workplace hazard identification and accident prevention. Unfortunately, this proactive safety effort is often seen as a non-obligatory and non-valued workload that depletes the workers' resources, such as time and energy required for work (Salas et al., 2016). In the study of Mckinnon (2012), supervisors of a water services department expressed that the near miss program is an additional workload that would distract them from their core responsibility of supervising workers (Mckinnon, 2012). Near miss reporting can be a time-consuming effort, particularly when the system heavily depends on paperwork for reporting (Singal et al., 2018; Yang et al., 2014). In the study of Singal et al. (2018), lack of time to submit near miss reports was found to be the most perceived barrier, with 79.5% of the respondents citing time constraints as a factor in the low reporting rate. This finding is also supported by Zhou et al. (2019) and Hasanspahic et al. (2022), where the workers considered reporting to be a complicated and time-consuming process. Geoffrey (1999); Storgard et al. (2012); Hasansphaic et al. (2020) and Haas et al. (2020) found workers refuse to spend time on reporting as there could be too many near-misses occurring daily during operations and it is impossible to stop their work for reporting. Leaders who prioritise production performances over safety goals have reduced or totally diminished the number of near miss reports (Williamsen, 2013; Singal et al., 208; Duryan et al., 2020). A case study in the shipping industry revealed that a lack of ship's master's support for safety reporting has led to a low reporting rate among the vessel's crew (Storgard et al., 2012). When workers have tight production deadlines to meet or are under intense pressure to complete the project on schedule, they may choose to accept the risk by ignoring unsafe conditions to avoid work interruption, as they have limited time to decide whether the encountered unsafe conditions at work can wait or whether immediate attention is required (Geoffrey, 1999; Williamsen et al., 2013; Haas et al., 2020). Leaders support, in terms of safety priority and time allocation, is therefore critical to promote near miss reporting (Whiteoak and Appleby, 2019; Haas et al., 2020).

Leader or supervisory feedback is a vital form of safety communication. It is the one-way verbal dissemination of information from management about the worker' performance in the workplace (Salas et al., 2016). There are two main types of leader feedback that influence the success of a near miss reporting program: leader recognition for reporting behaviours, and feedback on the actions taken to rectify the causes of the reported near misses (Mckinnon, 2012; Haas and Yorio, 2019). According to Gnoni et al. (2020), the best reward system to encourage near miss reporting is to inform workers that their reported issues have been acknowledged, addressed and fixed. Positive behaviour reinforcement through leader' recognition has been found to be the most effective leadership behaviour to promote the near miss reporting program (Mckinon, 2012; Salas et al., 2016; Bridges, 2012). In fact, the significant impact of management feedback on safety reporting has long been explored by researchers in the safety field. Clarke (1998) revealed that the willingness of train drivers to report accidents encountered is strongly determined by their managerial reactions, whether their manager is responsive and concerned or not, about safety incidents. In a more recent study, Molnar et al. (2019) concluded that providing positive feedback to workers can support their needs and satisfaction, which in turn increases intrinsic motivation at work to

engage in safety participation. A supervisor or leader who is lax in enforcing the reporting system through direct reward has been reported to have a low reporting rate, even if their management sets safety goals to demand safety reporting (Probst and Estrada, 2010). Despite the concerns that providing recognitions to the reporting behaviours may lead to misleading data, such as fabricating or making meaningless reports, as highlighted in the early section of this paper (Phimister et al., 2003; Hasanspahic et al., 2022). Non-monetary incentive or positive managerial feedback such as verbal reward, praise or appreciation for the reporting behaviours can infuse a sense of accomplishment in workers, thus motivating them and increasing their confidence and dedication to voice out potential hazards at the workplace (Bridges, 2012; Salas et al., 2016).

Delaying feedback or a lack of quick results is one of the main factors for the failure of a near miss reporting program (Mckinnon, 2012). Phimister et al. (2003); Storgard et al. (2012); Williamsen (2013) and Zhou et al. (2019) reported that workers get frustrated, disappointed and doubt the usefulness of the reporting system when their reporting efforts do not lead to any immediate remedial actions or safety improvements. In the study by Probst and Estrada (2010), about half of the respondents perceived that their management does not value safety and that nothing will be done to fix the reported near misses. 66.3% of respondents revealed a lack of perceived change after reporting a patient safety event (Singal et al., 2018). These results also aligned with the findings of Bridges (2000), where low levels of perceived management commitments to safety led to near miss under-reporting. Being proactive could be a risky behaviour that exposes workers to criticism, complaints and blaming (Bridges, 2012). If workers learn that no further actions, such as incident investigations and corrective actions, can be expected, they will not take the risk of reporting the potential hazards (Probst and Estrada, 2010). Leaders' timely feedback to workers, either through acknowledgement of the reported hazards or provide intervention for hazard corrections, is therefore equally important to improve near miss reporting in the workplace (Storgard et al., 2012; Haas et al., 2020; Haas and Yorio, 2019).

5.5 The reciprocal relationship of near miss reporting behaviour

Extant literature has evidenced the interaction of safety climate with workers' safety knowledge, workers' perceived risk, coworkers' norms and safety leadership (Cecchini et al., 2018; Choo et al., 2017; Clarke, 2010; He et al., 2021; Jiang et al., 2010; Probst and Estrada, 2010). These interactions, either through moderation or mediation, should be carefully considered when developing an effective near miss management system. Safety climate is defined as workers' shared perceptions regarding the safety policies, procedures and practices in the workplace (Schneider et al., 2013). This shared perception plays an important role in determining workplace safety achievements, as workers rely on the organisation underlying logic of actions in the work environment to decide whether their safety behaviours likely to be supported or not (Ostroff et al., 2012; Zohar and Hofmann, 2012). Safety climate is found associated with a range of safety performances and outcomes, including workers' safety behaviour (Rusyda and Siti, 2021; Pandita et al., 2019), number of workplace injuries and incidents (Aljabri et al.,2020; Khoshakhlagh et al., 2021; Yanar et al., 2019) and accident reporting (Probst and Estrada, 2010).

This section explained the interaction of key factors through, the reciprocal relationship of near miss reporting behaviour with both organisation and psychological safety climates (see Figure 4). With regards to safety knowledge, Jiang et al. (2010) revealed that workers are more willing to learn about safety knowledge and speak up for safety when the safety climate of the organisation is high. The more confident the workers are with their knowledge, the more they speak up and participate in safety promotion. This finding is supported by Edmondson (2019) and Salas et al. (2016), where both studies suggested that the relationship between psychological safety and knowledge sharing is moderated by the level of confidence that workers have in the knowledge to be shared. Numerous studies have shown that strong supportive safety climates, such as innovative and cooperative climates, favour interaction among workers and thus promote the process of knowledge sharing, particularly in terms of implicit knowledge (Pandita et al., 2019; Putra et al., 2022; Choudhury and Das, 2021). On the other hand, near miss is in fact a knowledge production (Haas et al., 2020). While a better safety knowledge helps to promote near miss reporting, the reported near miss events allow organisation to gather knowledge and assess information around safety hazards. It is therefore a good source of information for workers to learn about the relevant safety hazards in their job and build knowledge around hazard recognition and risk mitigation (Haas and Yorio, 2019; Haas et al., 2020).

Figure 4 The reciprocal relationship of near miss reporting behaviour

In terms of workers' perceived risk, relevant studies indicated that psychological safety climate is strongly related to workers' perceived risk of speaking up about safety at work. According to Liang et al. (2012), workers' expression of concerns about work practices, incidents, or unsafe behaviour is defined as a prohibitive voice. Lack of psychological safety at the workplace can reduce prohibitive voice and promote defensive silence, where workers tend to withhold information and issues based on fear of negative consequences (Pinder and Harlos, 2001). The willingness and confidence of workers to practice open communication about safety issues highly depends on their level of trust with the organisation. A positive safety climate with just culture can instil a sense of

psychological safety among workers, in which they perceive reporting on safety incidents as acceptable behaviour and shall not be disciplined (Reason, 1997). It is important for organisations to create a just culture to convince their workers that the near miss management program is a fact-finding instead of fault-finding system, and that the workers will not be held accountable for the near misses reported (Williamsen, 2013; Mckinnon, 2012; Probst et al., 2008; Haas and Yorio, 2019). In addition, near miss reporting is also found to increase workers' perceived risk towards potential hazards in the workplace. According to Galloway (2019), inaccurate risk perception and repeated success of risky attempts are both prevalence factors that contribute to risk taking behaviour at work. When workers experience a near miss in a high-risk situation without any significant impact, it will lead to a misperception where they will either underestimate the risk and/or overestimate their capability to overcome the hazards. This misperception is exacerbated when the near miss experience is repeated without impact and no further actions were taken to address the potential harmful consequences. Workers may build up a sense of resilience and tend to be more tolerant of such risks in the future and make riskier decisions (Haas and Yorio, 2019). Near miss reporting behaviour can therefore increases worker risk perception towards the hazards as it allows them to get involved in the process of hazard recognitions and potential consequence anticipation.

Workers' willingness to speak out for safety in the workplace is determined by coworker support. Salas et al. (2016) discovered that perceived coworker support for safety mediated the perceived organisation support for workers safety voices. This finding is supported by Kapp (2012), where transformational and contingent reward leadership were associated with higher safety compliance only when the group safety climate was positive. A strong safety climate in a workgroup enhances group members' support, value and appreciation for the safety practices. In contrast, when the safety climate is poor, workers become uncertain as to whether safety behaviours and practices are accepted by other group members (Lu et al., 2019). Coworker support not only acts as an important channel for workplace safety communication, but also mediates the relationship between organisational support and worker safety voice (Tucker et al., 2008). A meta-analytic study conducted by Christian et al. (2009) has discovered that the safety behaviour mediation effect on safety climate and workplace accidents is stronger for group safety climate compared to individual-level safety climate (Probst and Estrada, 2010). The reciprocal effect between near miss reporting behaviour and coworkers' norms can be further explained by the concept of positive deviance used by policymakers in early 1970 for public health improvement interventions (Marra et al., 2013). The concept of positive deviance involved identifying individuals with better outcomes than their peers (positive deviance) and enabling communities to adopt the behaviours for improved outcomes. This concept was later introduced into the workplace safety management to improve safety performance among work groups. Through the identification of positive deviants and their outstanding safety behaviour such as reporting on near misses, the desired safety outcome can be disseminated and adopted by other members of the work group (Galloway, 2019).

In the context of safety leadership, numerous studies have indicated that the strength of leadership influences on workers' safety voices is moderated by the safety climate (Kapp, 2012; Brondino et al., 2020; He et al., 2021). The impact of positive safety leadership to promote workers' initiative for safety participation and compliance is stronger in a positively perceived safety climate. In a study assessing the moderating

effects of safety climate on leadership, the results indicated that a good safety climate strengthens the relationship between safety leadership and workers' performance goal orientation in the near miss management system (Lu et al., 2019). The interactions between leadership, safety climate, and safety voice can be further explained through leader-member exchange theory (Salas et al., 2016). Leader-member exchange is a dynamic and mutual interaction between subordinates (workers) and the leaders (Salas et al., 2016). According to the study of He et al. (2021), high-quality leader-member exchange encourages construction workers' initiative on safety participation, and the safety behaviour is mediated by the safety climate. Under the condition of a positive safety climate, high quality leader–member exchange predicted the likelihood of workers expanding their safety role beyond safety obligation compliance (Salas et al., 2016). As proposed by the theory of reciprocal determinism, both parties' obligations are reciprocated in a targeted way. While a positive safety leadership can leads to an increase of workers' safety reporting in a constructive manner, this safety feedback is in turn benefitting the leader by allowing more comprehensive safety practices and a reduction in accidents and injuries, which therefore improves the achievement of safety goals for better safety leadership performance (Salas et al., 2016).

6 Conclusions

The study review has confirmed the reciprocal interaction between near miss reporting behaviour, organisational safety climate and psychological safety climate in the workplace. This finding filled up the current research gap where key factors are being studied as independent determinants for near miss reporting. By knowing that the key factors are affecting each other, and vice versa, safety researchers and practitioners will be able to recognise the underlying factors that impede near miss reporting behaviour and take into consideration when developing an effective near miss management system, as well as to improve near miss identification training by outlining the critical barriers. While numerous studies have evidenced the significant impact of key factors on near miss reporting, limited research is available to support the influence of near miss reporting behaviour on safety climate. Existing literature on the positive influence of near miss reporting behaviour and its contribution to workplace safety outcome are mostly based on theoretical constructs. Future studies should focus more on exploring the beneficial influence of near miss reporting behaviour towards the workplace safety climate, particularly in the context of workers' norms and safety leadership to advocate the adoption and continual improvement of near miss incident management system.

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