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Review

Psychosocial factors and safety in high-risk industries: A systematic literature review

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ABSTRACT

Most large-scale industrial catastrophes (like the Deepwater Horizon oil spill, or Fukushima-Daiichi nuclear disaster) result from a combination of faults in technical arrangements and neglected social structures featuring a workplace. Whereas it has been acknowledged that human-factor causes can be attributed to accidents in high-risk industries, research in this domain remains scattered and in need of integration. Considered from a psychological perspective, the primary objective of this study is therefore to systematically review existing associations between psychosocial work characteristics and safety in high-risk industries. While grounded in the Job Demands-Resources (JD-R) theoretical model, this study adopts a systematic literature methodology and synthesizes identified empirical evidence through a framework synthesis approach. Results indicate that there is preliminary evidence of a link between the exposure to workplace psychosocial factors and safety in high-risk industries. Studies of the linkages between psychosocial factors and safety behavior are more prevalent and do more often find significant associations between the variables than studies that investigate associations between psychosocial factors and safety outputs. Moreover, results indicate that job demand factors are likely to trigger employees' health-impairing mental/physical conditions that can constitute a precursor of unsafe behavior. Results imply as well the existence of a link between work-induced psychosocial states (typically in a form of stress or exhaustion) and safety. Limitations in the existing evidence base are recognized, thoroughly discussed with several suggestions for further development of the research field being offered. Practical and theoretical implications of the results are presented.

1. Introduction

Safety is of paramount importance especially for organizations and individuals operating in high-risk industries such as oil and gas or nuclear power, where the likelihood that something can go wrong is acceptably very small. Early efforts to advance workplace safety management and accident prevention gravitated towards the individual worker, the design of one's respective working conditions, and the basic protection (Hofmann et al., 2017). This traditional perspective implied as well that improved safety performance would manifest itself in terms of reduction of, for example, reportable occupational injuries and accidents, environmental incidents, and accident-related production losses (Hollnagel, 2014), which have often been explained by reference to human error models (Read et al., 2021). To illustrate this line of thinking, Reason (1990) reported that in the confluence of a whole series or chain of errors, human-factor causes can be attributed to 70–80 % of accidents in high-hazard industries. Similarly, it has been appraised that human error is involved in 70 % of aircraft accidents (Hawkins, 1993) and 80 % of shipping accidents (Lucas, 1997). Others provided further (less conservative) pieces of evidence indicating that employees' unsafe behaviors trigger between 80 % and 95 % of all workplace accidents (Masia and Pienaar, 2011; Paul and Maiti, 2005).

Be that as it may, it is now widely recognized that accidents in complex man–machine systems are usually caused by a multitude of events, which occur in a coincidental manner that at times has never been foreseen (Dekker et al., 2011). In the field of ergonomics and human factor research, there has been a fundamental shift in focus from a simple human-technology interaction view to a broader and more holistic way of thinking, emphasizing complex non-linear and non-deterministic interactions and relationships (Read et al., 2021). Consequently, it has been argued that the term "human error" should be replaced with a term that do not indicate any attributional assumptions to the individual, for instance, "action error" (Mathisen et al., 2017). Along this line, Read et al. (2021) argued that "accidents cannot be

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attributed to the behavior of an individual component (i.e., a human error), instead we must examine how interactions between components failed; that is, how the system itself failed" (p. 1092). In this connection, Mearns et al. (2003) asserted that the reliability of complex work systems in achieving operational safety goals depends not only on technical arrangements, but also on existing psychosocial structures featuring a workplace.

Having considered the aforementioned arguments, it is evident that whereas increasing our understanding of and eliminating major causes of workers' errors and unsafe behaviors is still required, there is also a need for comprehending individuals' workplace behaviors more holistically. While an abundance of high-quality research reviews into workplace safety management and accident causation already exists (see, e.g., Beus et al., 2016; Hofmann et al., 2017 for extensive reviews), we remain in need for further discussion and application of more comprehensive and integrated models that would synthesize and account for the role of cognitive challenges, emotional states, organization of tasks and work stress, as well as health and work environmental factors in safety–critical settings (Bergh et al., 2014; Cornelissen et al., 2017). To meet this end and to go beyond the culture of 'blamism' that underlies many 'human error' studies, this project pays particular attention to the subject of generic work-related psychosocial factors in high-risk industries. Specifically, the primary objective of our study is to investigate associations between a broad spectrum of psychosocial work characteristics and safety factors pertinent to high-risk industries. Furthermore, in accordance with contemporary research perspectives on action error, this investigation aims to identify work-related psychosocial factors that may increase the risk of errors and accidents (i.e., in line with Safety I thinking) as well as factors that are evident when everything "goes right" (i.e., in line with Safety II thinking) (e.g., Read et al., 2021). Along this line, the Job Demands-Resources model (JD-R) (Bakker and Demerouti, 2007) has formed a theoretical background for the study as it parallels to a great extent the reasoning represented by Safety I and Safety II thinking. The model provides a comprehensive framework for studying workplace psychosocial factors, including both adverse (demands) and beneficial (resources) pathways that influence employees' wellbeing and in turn safety-specific behavior and safety outcomes.

2. Theoretical background

2.1. Psychosocial work environment

Scholars and practitioners jointly agree that whenever studying psychosocial work environments, one needs to draw the line between concepts representing psychosocial factors, psychosocial hazards, psychosocial risks, and work-related stress to avoid any possible misconceptions. The term *psychosocial factor* does not carry positive nor negative connotations *per se* and the existing literature associates psychosocial factors with features of the work environment that "include, among others, work demands, the availability of organizational support, rewards, and interpersonal relationships in the workplace" (Leka et al., 2017, p. 1). Referring to *psychosocial hazards*, these specific aspects of work organization, design, and management have the inherent potential to cause adverse effects on individual (e.g., health and safety) and/or organizational (e.g., reduced productivity) outcomes (Leka et al., 2015). Furthermore, a *psychosocial risk* refers to the likelihood of psychosocial hazards to cause harm (British Standards Institution (BSI), 2011). To illustrate this, let us consider an employee experiencing pressure at work (i.e., a psychosocial factor). If not managed responsibly and effectively in the work environment, the work-induced pressure can swiftly become harmful (i.e., as a psychosocial hazard). Then, when pressure at work is chronic and unmanageable (i.e., there is every likelihood that it will cause harm), it results in work-related stress, which is now defined as a negative experience resulting from direct exposure to poor working conditions (Cox and Griffiths, 2010). Recognizing these differences, this study takes a closer look at psychosocial factors with their both beneficial and harmful effects, as the objective here is to identify core factors that are potentially positively as well as negatively associated with safety outputs.

Moreover, as the main aim of this paper is to evaluate the importance of several work features when it comes to safety outcomes, it was necessary to look at a well-established theory of psychosocial factors when developing our approach. One such theory is the Job Demands Resources model (JD-R model, Bakker and Demerouti, 2007). This model builds on the influential models of Job Demands Control (Karasek, 1979) and Job Demands Control Support (Johnson and Hall, 1988) where perceived control and social support buffer negative effects of demands on an individual's well-being and performance. The JD-R model offers a coherent framework when analyzing the demands as well as resources inherent in different types of occupations, including high risk jobs. For the sake of clarity, it should be noted as well that job demands are "those physical, psychological, social, or organizational aspects of the job that require sustained physical and/or psychological (cognitive and emotional) effort or skills" (Bakker and Demerouti, 2007, p. 312). Job resources, on the other hand, refer to "those physical, psychological, social, or organizational aspects of the job that are either/or functional in achieving work goals; reduce job demands and the associated physiological and psychological costs; stimulate personal growth, learning, and development" (p. 312). It should be further marked, that following a recognized strand of organizational multilevel research (e.g., Klein and Kozlowski, 2000), Bakker and Demerouti (2018) conceded quite recently that organizational life should be modeled at various levels (i.e., macro-organizational, micro-organizational/team/workgroup, and individual) so as to overcome the overly simplistic reasoning based solely on the individual, employee perspective.

Besides the premises of the JD-R theory, Bakker and Demerouti (2007) further propose that the two sets of psychosocial factors may each evoke a dual psychological process: the 'health impairment process' and/or the 'motivational process'. In particular, Schaufeli and Bakker (2004) argue that job demands are likely to initiate a cascade of mental processes leading to a depletion of an employee's mental and physical resources, and result (if exposed over a long time period) in chronic exhaustion, physical health problems, and diminished work engagement and performance. In contrast, job resources (which initiate a motivational process) are thought to foster employees' growth, learning, and development on the one hand, and buffer the stressful (health-impairing) experiences on the other, thereby building a stronger dedication to one's work. Fig. 1 illustrates these associations.

A growing body of research that relies on the JD-R theory indicates that the identified aspects of working conditions have the potential to predict not only such outcomes as performance, citizenship behaviors, or absenteeism (e.g., Rich et al., 2010; Schaufeli et al., 2009), but also diverse safety–critical outputs (Hansez and Chmiel, 2010; Li et al., 2013) which is also the focus area of the current paper. Concisely, it has been argued that unsafe behaviors of human operators in complex technology-driven industries (and the resulting incidents and accidents) cannot be fully comprehended as we fail to account for employees' experiences of work-related psychosocial phenomena.

2.2. Safety performance in high-risk industries

A large and diverse literature is available on workplace safety, accident and injury research (see, e.g., Khanzode et al., 2012; Pillay, 2015 for comprehensive reviews). Within the confines of the current project, an exploratory approach has been adopted to scrutinize previously characterized psychosocial factors contributing to the occurrence of hazardous situations in a given work system. Specifically, available evidence shows that certain actions can lead to unwanted subsequent outcomes such as accidents or injuries. In this regard, a major distinction has been made between errors and violations (Mathisen and Bergh,

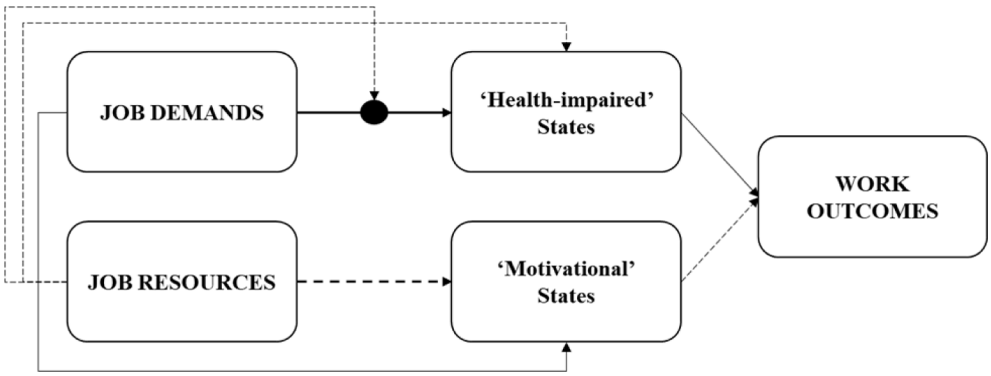

Fig. 1. JD-R model: A dual psychological process.

2016; Reason, 1990). Action errors are defined as "unintended deviations from plans, goals, or adequate feedback processing, as well as incorrect actions resulting from lack of knowledge" (Frese and Keith, 2015, p. 662). On the other hand, violations involve more conscious intentions of non-compliance, such as failing to follow rules and procedures with which one is familiar (Grabowski et al., 2009). Important to note is that violations need not arise from harmful intention but can result from a perceived need to take short cuts, particularly if rules and procedures are perceived as inexpedient and the violations can sometimes be accepted as informal routines (Alper and Karsh, 2009; Liang et al., 2018). Be that as it may, action errors and rule violations at work can lead to a number of adverse consequences including accidents, injuries and catastrophes (Frese and Keith, 2015; Hale and Hovden, 1998; Skalle et al., 2014). For instance, violation of safety rules, procedures and norms that precede serious accidents have been documented in aviation maintenance (Hobbs and Williamson, 2002), mining (Laurence, 2005), railroad (Lawton, 1998), and oil and gas (Walker et al., 2012).

On the other hand, Neal and Griffin (1997) accentuated that individuals at work also exhibit potentially 'benefiting' actions and behaviors (contrary to safety violations) that promote health and safety, and they considered these acts to consist of two components: safety compliance and safety participation. Along this line, safety compliance refers to following "safety procedures and carrying out work in a safe manner", whereas safety participation refers to "helping coworkers, promoting the safety program within the workplace, demonstrating initiative, and putting effort into improving safety in the workplace" (Neal et al., 2000, p. 101).

Thus, there are two perspectives that need to be taken into account when attempting to fully comprehend and assess workers' safety-related actions. The two perspectives reflect the Safety I and Safety II thinking where action errors and violations are conceptualized from an accident and incident preventing perspective (Safety I) whereas the 'benefiting' actions and behaviors perspective is conceptualized from a focus on what works well and goes right (Hollnagel, 2013). Accordingly, one may contend that the two perspectives should be seen as complimentary in order to achieve a greater understanding of organizational safety performance. That is, one may focus on potentially hampering safety violating behaviors and/or one may consider the extent to which individuals comply with established safety norms and participate in spreading them in the occupational setting.

Regarding the *consequences* of workers' undertakings (i.e., safe vs unsafe behaviors), there are two overarching domains encompassing ultimate safety outcomes, which have been labeled as personal safety and process (i.e., operational) safety (Swuste et al., 2016; Tang et al., 2018). Whereas personal safety deals with matters resulting in injuries and fatalities of workers (Mearns and Hope, 2005), process safety concerns hazards leading not only to injuries and fatalities, but property and environmental damages as well (Knegtering and Pasman, 2009). To complement the discussion around the negative safety outcomes that apparently come in different forms, one may also draw upon the compressed classification of Cornelissen et al. (2017), that is based on Heinrich's pyramid (Heinrich, 1941), which indicates the following. Negative outcomes that have the potential to result in the infliction of serious harm can be seen as incidents (e.g., near-misses). Further, incidents that result in property and/or financial loss shall be understood as accidents, and the accidents that result in individuals' mental and/or physical damage can be called as injuries. In a similar vein, Khanzode et al. (2012, p. 1356) accentuated that "every accident need not necessarily result in human injury, but every injury is a result of an incident that can be termed as accident". Fig. 2 provides a summary of provided lines of reasoning.

2.3. Developed conceptual framework

In recent years, a number of theoretical models have been conceptualized by safety scholars to guide empirical research (Beus et al., 2016; Hofmann et al., 2017). Although we do maintain that available perspectives are cumulatively useful in improving safety knowledge and practice, we sought to integrate the abovementioned arguments into a single, guiding framework to advance the workplace safety literature and ease the process of a systematic review. The proposed comprehensive frame is depicted in Fig. 3. To explore a nomological network of unfolding psychosocial factors at work and their associations with safety outcomes in the context of high-risk industries, we have integrated the following propositions. First, at the conceptual level the framework departs from the Job Demands-Resources theory (JD-R), which accounts for two specific sets of working conditions (i.e., job demands and job resources) that can be found in every organizational context (Chirico, 2016). Second, in line with Bakker and Demerouti (2018) view, we recognize the direct impact psychosocial job factors have on the

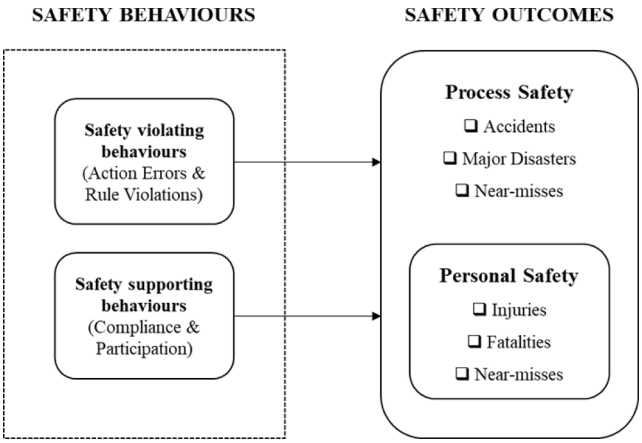

Fig. 2. Safety factors.

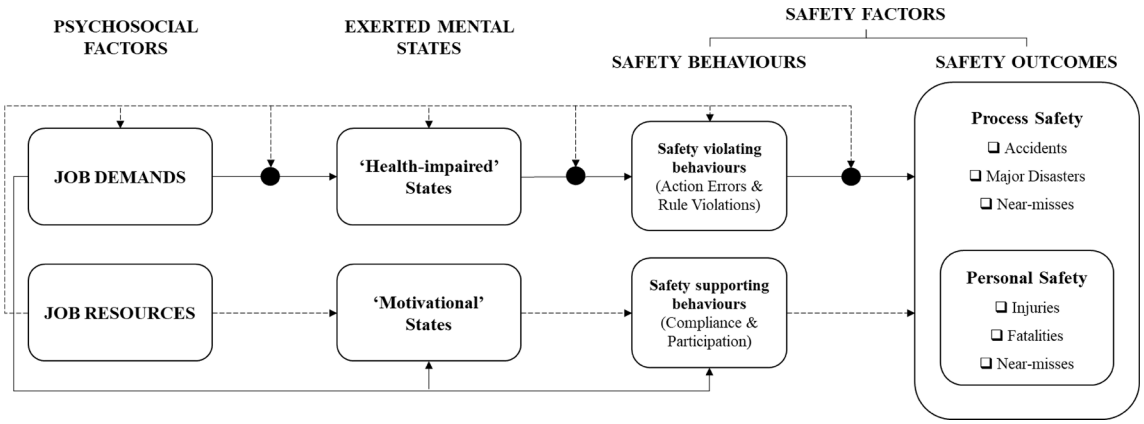

Fig. 3. Guiding conceptual framework.

individual's physical and mental states, as well as the distinctive role of job resources in buffering the diminishing effects of job demands. Third, this project builds on existing safety literature by providing a conjoint safety performance framework, which incorporates behavioral and the resultant safety concepts that prevail in existing workplace studies. Thus, one of the key contributions of the present review is that we attempt to incorporate the logic represented by the Safety I and the Safety II thinking into the model that views psychosocial factors from both adverse and favorable perspectives.

All things considered, we are of the view that the benefit of using the proposed model as a framework to guide this review is that it provides a strong conceptual basis for exploring psychosocial factors at work and their associations with selected safety outcomes. By applying the JD-R model as a way to organize the relatively scattered and multidisciplinary research on psychosocial factors this review gives an overview of which psychosocial factors have been studied in the high-risk industries, what emphasis has been made on Safety I and Safety II thinking in this regard, and what are the links between the different psychosocial factors and safety behavior- and performance. In addition, this approach facilitates the identification of existing knowledge gaps that preferably shall direct researchers' attention to areas that need further empirical substantiation.

3. Methodology

This project adopted a systematic literature review methodology recently discussed, for instance, by Snyder (2019), and was conducted systematically by adhering to methodological guidelines offered by the EPPI-Centre that is based in the Social Science Research Unit in the Department of Social Science, UCL Institute of Education, University College London (https://eppi.ioe.ac.uk/cms/). The EPPI-Centre is a specialist institution that continuously develops methods for systematic reviewing and synthesis of research evidence. As such, based on the EPPI-Centre guidelines, this study followed the framework presented by Gough et al. (2017), where the respective components of the systematic literature review were carefully addressed throughout the study: (a) clarifying the problem, and question (here, elaborated upon in Section 1. *Introduction*); (b) finding studies within the scope (here, discussed in Section 3. *Methodology*); (c) describing in terms of conceptual framework and to manage the review (here, presented in Section 2. *Theoretical background*); (d) synthesizing using the conceptual framework (here, conducted in Section 4. *Results*, and in Discussion part: Section 5.1. *Synthesis of findings*); (e) appraising relevance and quality of the evidence (here, elaborated upon across Section 5. *Discussion*, and methodological Section 3.2.2. *Study selection*); and (f) engaging stakeholders to interpret and make use of the evidence (mostly undertaken when a study is published).

3.1. Delineating the context: High-risk industries

At this stage, it is essential to delineate contextual boundaries of what we have called so far, a high-risk industry. According to Aase and Nybo (2005), high-risk industries are often characterized "by the overall demand for high reliability because of their unique potentials for catastrophic consequences. Characteristics like complexity, interdependencies, and proximity to hazard can be used to characterize different types of high-risk industries" (p. 50). Moreover, Carroll (1995) marks that in high-hazard industries "… complexity, tight coupling (interdependence), and invisibility make safe operation and learning from experience particularly difficult" (p. 175). What's more, Scharf et al. (2001) assert that the most hazardous work environments share one feature that they all have in common: a constant change. In this vein, Meshkati (1991) argues that a distinctive feature of many high-risk, large-scale technological systems, such as nuclear power plants and offshore oil rigs, "is the large amounts of potentially hazardous materials that are concentrated in single sites and under the centralized control of a few operators" (p. 134). In case of catastrophic breakdowns of these systems, threats not only to those within the installation, but also to the neighboring public, and even the whole region and the country can be identified. Thus, taken together, one may concede that hazardous environmental, physical, and unobservable (e.g., psychosocial) factors (Reason, 1990) are all in place in high-risk industries, which ought to be featured as complex (e.g., technologically advanced), interdependent, continuously changing, operating with proximity to hazards and the potential for catastrophic breakdowns. Examples of such industries are nuclear power plants, transportation systems (e.g., aircrafts, space shuttles, shipping), chemical plants, offshore installations, construction sites, and mining.

3.2. Data extraction

3.2.1. Systematic literature search

A systematic search in four bibliographical databases was carried out (i.e., PsycINFO, Web of Science, Scopus, and EBSCO; the final search date: 6th of June 2019) in accord with guidelines by Atkinson et al. (2015) as well as Rader et al. (2014). Search terms consisted of three groups of keywords: "psychosocial factors" (e.g., psychosocial risk/hazard/factor, etc.), "high-risk industry" (e.g., high-risk job, high-risk occupation, etc.) and "safety" (e.g., injuries, accidents, etc.). The three categories were combined with the Boolean operator AND. We included many closely related search terms for all three groups of keywords to minimize the possibility of missing out relevant studies. Along this line, to remain inclusive in our searching approach, no specific range of publication dates have been predefined. Consequently, the initial literature search resulted in 1936 hits.

3.2.2. Study selection

After completing the initial searching phase, the first author screened all titles and abstracts for relevance, which resulted in 151 remaining papers (once the duplicates were removed). This early screening stage led to what Atkinson et al. (2015) call "a broad determination of relevance" (p. 91). Here, studies concerning individuals working as firefighters, soldiers, police officers, healthcare providers, farmers, prison guards/officers were not included in this review, as these occupations do not fall under the definition of a high-risk industry presented in Section 3.1. Moreover, articles were excluded from further investigation if it was clear from the title and the abstract that they did not examine psychosocial work characteristics in relation to safety matters (e.g., studies focusing on measurements development; inquiries into employees' physical health only; or training programs). Subsequently, two experts (one professor and one industry professional) were asked to screen for eligibility the titles and the abstracts of selected 151 articles (as a form of external validation). Fifty-two papers remained, and 4 additional studies were recommended due to their claimed relevance. Further, a 'backward' or 'retrospective' reference list checking was performed to scan references cited in papers included in the final pool (i.e., of 56 articles). As a result, 33 admissible hits emerged after their titles and abstracts were verified for significance (i.e., 56 + 33 new articles; the final search date: 25th of November 2019). On top of that, the same core 56 studies were used for undertaking 'forward' or 'prospective' reference list checking on the Web of Science database. Here, the objective was to identify and scan peer-reviewed publications where others have cited the identified 56 core studies. Again, the titles and abstracts from forward citations were scrutinized for relevance, and as such 113 new potentially admissible records were identified (i.e., 56 + 33 + 113 new articles; the final search date: 13th of April 2020). In the end, application of the presented searching and initial screening strategy brought about a total of 202 complete papers to be comprehensively appraised.

Moreover, following Atkinson et al.'s (2015) recommendations, in the second step of screening for relevance the detailed inclusion and exclusion criteria were adopted when working with full-length articles (see Table 1).

If a study did not comply with inclusion criteria, or conformed to any exclusion criteria, it was excluded from further analysis.

Moreover, to complement these efforts, guidelines, checklists, and recommendations provided by Jarde et al. (2012), Downes et al. (2016), and Hong et al. (2018) were used as a reference point for devising a methodological quality appraisal checklist (see Appendix A). The following criteria constituted the basis for our quality rating: a clearly described sampling strategy, an appropriate sampling strategy to address the research question, a representativeness of the sample discussed, an appropriate size of the sample for conducted statistical analysis, a clear description of the study context, a proper description of measurements (and their quality) for capturing IV(s) and DV(s), an analytical approach clearly described, a clear correspondence between selected data analysis approach and the investigated research question (s). Prior to appraisal of the articles, the two authors pretested, discussed the content, and calibrated the final criteria included in the checklist. Each article was then assessed for its methodological quality on a following scale: (0) bad, (1) acceptable, (2) well, (3) very well, with additional 'unclear' and 'not applicable' options in place. The highest possible score was 24 points. A relatively low threshold value of 8 points (that would in principle correspond to an 'acceptable' score on each quality criterion) was adopted so as to include as a rich (and yet credible) spectrum of articles as possible. Any conflicts or uncertainties pertaining to the assessment process of scrutinized articles were resolved by authors through discussion and consensus.

Taken together, all these steps have been performed to ensure the relevance of the study focus; suitability of study design/method; and that the methodological standards of a study are achieved – which are three subcomponents that should be included when preparing articles for further synthesis (Gough et al., 2017). After performing the described searching and selection procedures, 40 studies met all the criteria and were included in the present investigation. A flowchart detailing the adopted selection process of articles is presented in Fig. 4.

Table 1
Inclusion and exclusion criteria.

Domain	Include	Exclude
Subject	Focus on psychosocial factors in relation with safety phenomena	* Study that does not combine the subjects of psychosocial factors with the safety phenomena * Measurement development of psychosocial factors at work * Simulation, training and/or intervention study * Focus on an individual's physical health conditions
Occupational context	High-risk industries (*"Systems that are complex (e.g., technologically advanced), interdependent, continuously changing, operating with proximity to hazards and the potential for catastrophic breakdowns."*)	Not in line with provided definition of 'high-risk industry'
Participants	Sharp-end workers	Non-sharp-end workers, e.g., project or construction managers, architects, quantity surveyors, white-collar workers
Publication venue	Peer-reviewed article	* Book/book chapter(s) * Literature review * Periodical * Editorial * Dissertation * Report * On-going, unpublished manuscript * Conference proceedings
Method	* Empirical * Primary study * Quantitative	* Conceptual paper * Qualitative * Low/unknown psychometric properties of applied scales/measurements
Language	English	Non-English study

3.3. Analytical approach

Following Gough et al. (2017), this investigation has been designed to identify and organize relevant peer-reviewed publications, and further interpret and consolidate collected information in line with the non-statistical 'Framework Synthesis' (FS) method. The key distinguishing feature of this method (that belongs to the family of thematic summaries approaches) refers to the explicit application of a selected conceptual framework (here, presented in Section 2.3.) for the comprehension of a given academic field/domain. Moreover, it is also critical to note that in line with the FS method, as new strands of evidence emerge over the course of the investigation, the initially adopted frame is often expected to gradually expand in scope and complexity to accommodate and synthesize new information (here, presented in Section 5.2).

4. Results

Acquired evidence provides a rich and complex picture of how the psychosocial work environment interplays with safety factors in the context of high-risk industries. To facilitate the process of summarizing the results, this section has been split up into two parts. First, a brief descriptive information is given to illustrate when and where selected articles have been published; and so countries of origin of studies with

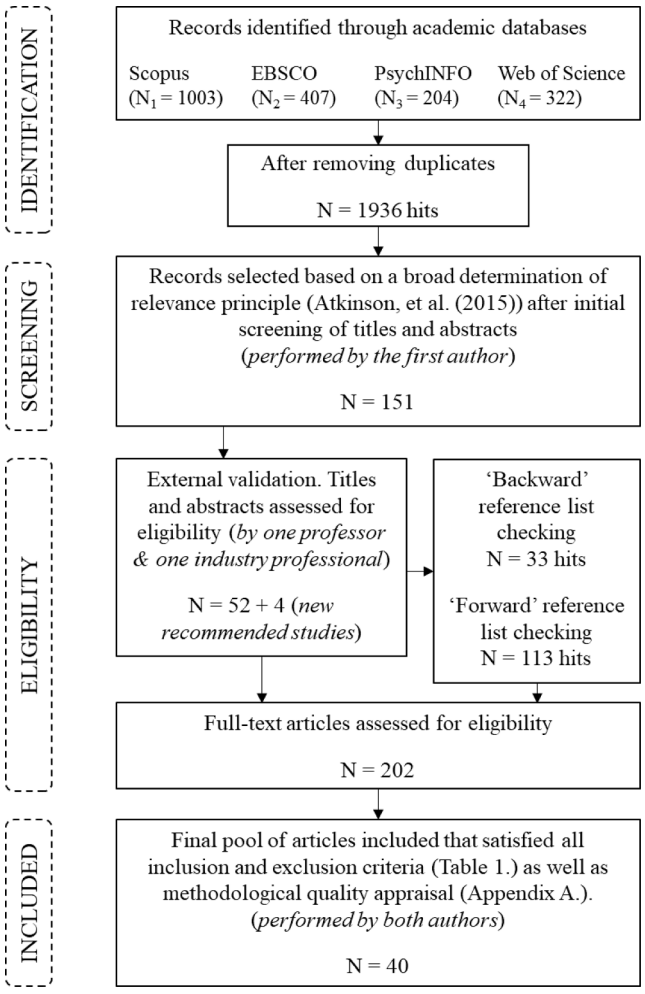

Fig. 4. The flowchart for the selection of studies.

specific high-risk industries are cross-tabulated (i.e., Section 4.1, *Research profiling*). Second, the devised conceptual framework (see Fig. 3) has been utilized in Section 4.2, *Thematic foci* to structure and group together identified phenomena into tables where Table 2 presents unique associations between psychosocial and safety factors; Table 3 focuses on psychosocial factors and exerted psychosocial states; and Table 4 enlists associations between exerted psychosocial states and safety factors.

4.1. Research profiling

The majority of investigated studies were published after 2012 (i.e., 31 out of 40 records, 77.5 %). Among the articles included in the sample, the oldest publication belongs to Smith and Folkard, and comes from 1993. Fig. 5 illustrates the gradual growth of interest into the subject of psychosocial factors and safety outcomes across the time.

With regard to publishing venues, the most popular journal was *Safety Science* (with 13 out of 40 studies included, i.e., 32.5 %). The second most often selected scientific journal was *Accident Analysis & Prevention* (with 4 out of 40 studies, i.e., 10 %). For a complete overview of peer-reviewed journals that hosted enquiries into psychosocial factors and safety outcomes in high-risk industries, see Fig. 6.

Finally, Fig. 7 depicts the interplay between the country of origin of a given study with the specific high-risk industry being investigated. Specifically, it can be observed that 7 out of 14 articles (i.e., 50 %) that examined psychosocial factors and safety outcomes on the construction sites came from China. Moreover, 7 out of 11 articles that investigated psychosocial factors and safety outcomes within the oil and gas industry came from Norway. The third largest group of studies came from Hong Kong, where again the construction industry context was in particular focus (i.e., 5 out of 14 publications: 35.7 %).

4.2. Thematic foci

As previously mentioned, Tables 2–4 provide a complete overview of observed relationships between work-related psychosocial factors, exerted psychosocial states experienced by employees, as well as the safety factors (i.e., safety behaviors and safety outcomes). Of import, whereas the JD-R model distinguishes primarily between psychosocial job demands and resources, this study follows (for the sake of comprehensiveness) an extended classification of these factors presented by Schaufeli (2017). That is, according to the author, job demands can further be divided into three subcategories (i.e., qualitative, quantitative, and organizational), while job resources can be represented by four subcategories (i.e., social, work-related, organizational, and developmental).

Having said that, results incorporated in Table 2 illustrate that among investigated studies, 22 referred to psychosocial job demands, 20 considered some form of psychosocial job resources, and only one adopted an approach where a general psychosocial risk indicator was being utilized. Regarding psychosocial job demands, several investigations have given considerable attention to the problem of job-induced pressure (e.g., work pressure, production pressure, or time pressure) as well as various forms of organizational demands. When it comes to psychosocial job resources, the most frequently studied ones touched upon the topics of support (e.g., supervisor/co-worker support, social, or organizational), leadership factors (e.g., LMX, trust, authenticity), or control (e.g., job control, behavior control, personal control). On top of that, the majority of scrutinized studies explored relationships between psychosocial factors and employees' diverse manifestations of safety behavior (here, out of 69 reported estimates, 12 turned out to be non-significant, i.e., 17 %). Safety outcomes in this context (like injuries, accidents, near-misses, etc.) not only received considerably less attention, but also 16 out of 31 presented estimates turned out to be non-significant, i.e., 52 %. Lastly, only three projects included in Table 2 used some form of objective (non-self-reported) measurements to capture safety performance phenomena, whereas the rest relied heavily on cross-sectional survey-based responses.

Table 3 provides a nuanced understanding of relations between psychosocial factors and exerted psychosocial states that are being experienced by employees working in high-risk industries. Specifically, within the sample of selected studies five investigations concentrated on psychosocial job demands. Similarly in terms of quantity, five projects considered some form of psychosocial job resources and their associations with workers' exerted psychosocial states. When keeping psychosocial job demands in focus, most of the inquiries explored diverse forms of organizational demands (like, e.g., role ambiguity, or lack of autonomy). Furthermore, when shifting attention to psychosocial job resources, the most frequently studied ones considered the topics of support (e.g., supervisor/co-worker support), and control (e.g., job control, personal control). Of relevance, one may observe that psychosocial job demands are most often discussed in relation to psychosocial states that impair worker's condition such as stress (e.g., job stress, emotional stress), and emotional exhaustion. A similar pattern can be recognized when it comes to psychosocial job resources, which appear to be alleviating the level of stress (e.g., psychological stress, job stress) and emotional exhaustion among employees. On top of that, out of 23 estimates characterizing relations between psychosocial job demands and exerted psychosocial states, only two turned out to be non-significant (i.e., 9 %). However, when one considers reported estimates for associations between psychosocial job resources and exerted states, five out of 16 showed non-significant results (i.e., 31 %). Lastly, all the investigations included in Table 3 are based on cross-sectional survey-

Table 2
Psychosocial factors and safety factors.

Psychosocial Factors			Safety Factors	Reference
Job Demands	Qualitative	Work pressure	(−) safety compliance	Kvalheim and Dahl (2016)
		Work pressure	(ns) safety participation(ns) safety compliance	Peng and Chan (2019)
		Work pressure	(+) accident rate	Pordanjani and Ebrahimi (2015)
		Work pressure	(+) accident(ns) near miss	Mearns et al. (2001)
		Work pressure	(−) mindful safety practices	Dahl and Kongsvik (2018)
		Shift work	(−) alertness	Smith and Folkard (1993)
		Safety related stress	(+) safety behavior	Wang et al. (2018)
		Psychological demands	(ns) safety compliance(ns) near miss(ns) injuries	Li et al. (2013)
		Physical demands	(ns) safety compliance(ns) near miss(ns) injuries	Li et al. (2013)
	Quantitative	Production pressure	(+) safety violation (+) safety motivation	Liang et al. (2018)
		Production pressure	(−) safety participation (−) safety compliance	Guo et al. (2016)
		Time pressure	(+) risk taking	Rubin et al. (2020)
		Quantitative demands	(−) situational awareness (+) risk taking	Sandhåland et al. (2017)
		Quantitative demands	(ns) safety citizenship role definition	Turner et al. (2005)
		Role overload	(−) safety compliance(ns) safety participation	Yuan et al. (2015)
		Role overload	(+) risky behavior	Gracia and Martínez-Córcoles (2018)
	Organizational	Unfair reward/treatment	(ns) safety behavior(ns) injury incidents	Leung et al. (2012)
		Lack of goal setting	(+) safety behavior (+) injury incidents	Leung et al. (2012)
		Job insecurity	(−) safety compliance	Masia and Pienaar (2011)
		Laissez faire leadership	(−) situational awareness (+) risk taking	Sandhåland et al. (2017)
		Job insecurity	(−) safety compliance(ns) safety participation	Yuan et al. (2015)
		Job stressors combination measure	(−) safety behavior	Seo et al. (2015)
		Job stressors combination measure	(−) situational awareness (+) unsafe behavior	Sneddon et al. (2013)
		Work ostracism	(+) unsafe behaviors	Chen and Li (2020)
		Distrust of offshore managers	(+) accidents and incidents offshore	Conchie and Donald (2006)
		Distrust of contractor staff	(+) accidents and incidents on the gas installation	Conchie and Donald (2006)
		Distrust of workmates	(+) near-miss events	Conchie and Donald (2006)
		Role ambiguity	(+) risky behavior	Gracia and Martínez-Córcoles (2018)
		Procedural vagueness	(−) safety compliance	Dahl et al. (2014)
Job Resources	Social	Supervisor support	(ns) near miss(ns) injuries (+) safety compliance	Li et al. (2013)
		Supervisor support	(ns) accidents (+) safety behavior	Leung et al. (2016)
		Co-worker support	(ns) near miss(ns) injuries (+) safety compliance	Li et al. (2013)
		Co-worker support	(+) safety compliance (+) safety participation	Yuan et al. (2015)
		Co-worker support	(ns) safety behavior(ns) accidents	Leung et al. (2016)
		Social support	(−) safety violation (−) safety motivation	Liang et al. (2018)
		Social support	(+) safety participation (+) safety compliance	Guo et al. (2016)
		LMX	(−) supervisors' situational safety violations (−) supervisors' routine safety violations (−) individuals' situational safety violations (−) individuals' routine safety violations (+) workers' safety involvement (+) management safety commitment	Liang and Zhang (2019)
		LMX	(−) individuals' situational safety violations (−) individuals' routine safety violations	Su et al. (2019)
		LMX	(+) upward safety communication	Kath et al. (2010)
		Authentic leadership	(−) unsafe actions (+) situational awareness	Sætrevik and Hystad (2017)

(*continued on next page*)

Table 2 (*continued*)

Psychosocial Factors			Safety Factors	Reference
		Authentic leadership	(+) situational awareness (−) risk taking	Sandhåland et al. (2017)
		Authentic leadership	(+) safety climate (−) risk perception	Nielsen et al. (2013)
		Trust	(−) hydrocarbon leaks^^^(ns) conflict	Olsen et al. (2015)
		Leadership	(−) hydrocarbon leaks^^^(ns) conflict	Olsen et al. (2015)
		Recognition and reward	(−) hydrocarbon leaks^^^(ns) conflict	Olsen et al. (2015)
		People development	(−) hydrocarbon leaks^^^(ns) conflict	Olsen et al. (2015)
		Handling of conflicts	(−) hydrocarbon leaks^^^(ns) conflict	Olsen et al. (2015)
		Job certainty	(ns) safety behavior(ns) accidents	Leung et al. (2016)
		Organizational support	(+) upward safety communication	Kath et al. (2010)
	Work	Psychosocial safety climate	(−) unsafe behavior^^^	Yu and Li (2020)
		Job control	(ns) safety behavior (+) accidents	Leung et al. (2016)
		Job control	(+) safety citizenship role definition	Turner et al. (2005)
		Perceived behavioral control	(+) safety participation (+) safety compliance	Peng and Chan (2019)
		Personal control	(ns) employee unsafe behavior	Ju et al. (2016)
		Management safety commitment	(−) safety compliance(ns) safety performance	Li et al. (2019)
		Decision latitude	(+) safety compliance(ns) near miss(ns) injuries	Li et al. (2013)
		Work clarity	(ns) accident (+) near miss	Mearns et al. (2001)
		Role clarity	(+) safety compliance	Dahl and Olsen (2013)
		Satisfactorily workload and influence	(−) hydrocarbon leaks^^^	Olsen et al. (2015)
Mixed approach	Psychosocial risk indicator (PRI)	PRI	(−) hydrocarbon leaks^^^	Bergh et al. (2014)

Abbreviations: **^^^** objective (non-self-report) measurement; **(+/−)** positive/negative empirical association between investigated concepts; **(ns)** non-significant empirical association between investigated concepts.

based responses.

Exerted psychosocial states are often depicted as mediating components that transition the effects of psychosocial factors on safety outcomes (see the JD-R model). Results from Table 4 show that there are only six studies included in the selected sample that consider ameliorating effects of positively laden exerted psychosocial states (hereafter 'attainments') on diverse safety performance measures. Among these investigations three of them explored the role of employee engagement, and two of them took a closer look on the effect of worker's job satisfaction. Additionally, there were altogether ten estimates linking employees' attainments with their diverse manifestations of safety behavior, and further safety outcomes (i.e., seven and three estimates, respectively). Out of these results, two estimates linking job satisfaction, and organizational commitment with safety compliance showed non-significant results. Furthermore, it appears that within the confines of the delineated literature, deteriorating effects of negatively laden exerted psychosocial states (hereafter 'impairments') on safety factors attracted considerably greater attention (i.e., there are 15 studies on the list). Here, seven inquiries addressed the role of stress (e.g., emotional stress, job stress, etc.) in the process of undermining reported safety outcomes. In a similar vein, employee's emotional exhaustion (included in four publications) was found to have a detrimental effect on diverse safety performance measures. Generally, one may observe as well that among investigated studies there were in total 35 estimates probing the associations between employees' experienced impairments and diverse performance measures (i.e., 25 for employees' safety behaviors, and ten for further safety outcomes). Here, eight and four estimates respectively (i.e., 32 %, and 40 %) indicated statistically non-significant relations.

5. Discussion

This systematic review summarizes what workplace safety research has so far accomplished when it comes to understanding the influence of the psychosocial work environment on safety related behaviors and ensuing incidents, accidents and injuries occurring in high-risk industries. Although it has long been recognized that employees' safety performance represents a valid precursor for major accidents and injuries (Christian et al., 2009), research and practice have not managed to fully comprehend what are the main psychosocial driving forces leading towards workers' (intentional or unintentional) safety-oriented misbehaviors or safety promoting behaviors. To address this gap, this systematic literature review provides at first clear definitions of relevant concepts commonly applied by occupational scholars who devote their efforts to building employee-supporting psychosocial work environments. Then, we offered a needed conceptual framework to support a systematic classification of the findings deriving from papers identified through the systematic review process. Thereafter, based on a careful review of the empirical studies gleaned from search results, we gave an account of investigated psychosocial factors embedded in various high-risk industries and their linkages with safety performance outcomes.

5.1. Synthesis of findings

5.1.1. Articles' context and scope

The interest in the research area has increased noticeably in the past few years as more than three quarters of the included articles in this review have been published in the last decade. However, the mean number of published studies in the last ten years is only 3.5 per year so there is still a great potential for scholarly endeavors to improve our

Table 3
Psychosocial factors and exerted psychosocial states.

Psychosocial Factors			Exerted Psychosocial States Impairments	Reference
Job Demands	Qualitative	Psychological demands	(+) emotional exhaustion	Li et al. (2013)
		Physical demands	(+) emotional exhaustion	Li et al. (2013)
	Quantitative	Work overload	(+) job stress (+) emotional stress	Leung et al. (2010)
		Role overload	(+) job dissatisfaction (+) safety dissatisfaction	Gracia and Martínez-Córcoles (2018)
	Organizational	Role ambiguity	(+) job stress (+) emotional stress	Leung et al. (2010)
		Role ambiguity	(+) job dissatisfaction (+) safety dissatisfaction	Gracia and Martínez-Córcoles (2018)
		Unfair reward and treatment	(+) job stress (+) emotional stress	Leung et al. (2010)
		Inter-role conflict	(+) job stress (+) emotional stress	Leung et al. (2010)
		Poor work group relationship	(+) job stress (+) emotional stress	Leung et al. (2010)
		Lack of autonomy	(ns) job stress (+) emotional stress	Leung et al. (2010)
		Lack of feedback	(ns) job stress (+) emotional stress	Leung et al. (2010)
		Work ostracism	(+) emotional exhaustion (−) psychological detachment	Chen and Li (2020)
		Job stressors combination measure	(+) fatigue	Seo et al. (2015)
Job Resources	Social	Supervisor support	(+) psychological stress(ns) physical stress	Leung et al. (2016)
		Supervisor support	(−) emotional exhaustion	Li et al. (2013)
		Management safety commitment	(−) job stress (−) fatalism	Li et al. (2019)
		Co-worker support	(ns) psychological stress (−) physical stress	Leung et al. (2016)
		Co-worker support	(−) emotional exhaustion	Li et al. (2013)
	Work	Job certainty	(−) psychological stress (−) physical stress	Leung et al. (2016)
		Job control	(ns) psychological stress(ns) physical stress	Leung et al. (2016)
		Personal control	(ns) emotional exhaustion	Ju et al. (2016)
		Decision latitude	(−) emotional exhaustion	Li et al. (2013)
	Organizational	Psychosocial safety climate	(−) stress (−) burnout	Yu and Li (2020)

Abbreviations: **(+/−)** positive/negative empirical association between investigated concepts; **(ns)** non-significant empirical association between investigated concepts.

understanding of the role psychosocial factors play in the high-risk sector. Moreover, three quarters of the articles originated from only four countries (China, Norway, Hong Kong, and UK) with more than half of the studies performed in China and Norway. Thus, the findings from this review are not representative across cultures and as such should be used with caution. In fact, Dollard et al. (2014) accentuated the need to account for cross-cultural differences when discussing the subject of workplace psychosocial factors as the comparison of results derived from Western and non-Western countries might not always be meaningful. Moreover, three quarters of the studies so far have been conducted in the construction-, oil and gas-, and mining industries. Although available evidence and a growing body of literature stresses the significance of cultivating a healthy psychosocial work environment, we do recognize as well that in technical cultures that are often driven by a proverb 'In God We Trust, All Others Bring Data' (after Epstein, 2021) a psychosocial type of information (even if quantified) may not always be given adequate attention.

5.1.2. Psychosocial and safety factors

One main conclusion from this review is that there is some evidence of a link between the exposure to workplace psychosocial factors (i.e., in the form of job demands and resources) and ensuing employees' safety violating (or supporting) behaviors in high-risk industries. A few decades of research point to the fact that action errors or violations (or conversely, compliance with established safety rules) can be explained to a certain extent by work-related psychosocial forces. For instance, available studies show that when a worker perceives one's job to be insecure (e.g., due to organizational restructuring, downsizing, or economic crisis), it affects not only one's job satisfaction (Sutherland and Cooper, 1996), but also safety behavior (Choudhry and Fang, 2008) or safety compliance (Masia and Pienaar, 2011). Moreover, studies of the linkages between psychosocial factors and safety behavior (e.g., Su et al., 2019) are more prevalent than studies that investigate associations between psychosocial factors and safety outputs (e.g., Olsen et al., 2015). A possible explanation of this is that safety behavior could be seen as a more immediate and tangible result of the psychosocial work environment whereas safety outputs may additionally be explained by a range of other components of the system such as technical issues, existing regulations, or the physical environment. In support of this explanation, only half of the studies that scrutinized associations between psychosocial factors and safety outputs reported significant findings, while as many as 80 % of the studies that placed the focus on safety behavior reported significant results.

Furthermore, our findings show that roughly an equal number of studies investigated some form of job demands and job resources at work (i.e., 22 and 20 publications respectively). This implies that existing literature represents and parallels the ideas embedded in the Safety I and Safety II line of thinking. This becomes even more evident when looking at the safety variables being investigated as these include both errors, unsafe behaviors, accidents and injuries (Safety I), and safety benefiting variables like safety participation and safety compliance (Safety II). Regarding the substance of examined job demands, the majority of studies of qualitative and quantitative demands involved some form of job-induced pressures, like production pressure (Liang et al., 2018),

Table 4
Exerted psychosocial states and safety factors.

Exerted Psychosocial States		Safety Factors	Reference
Attainments	Well-being	(−) unsafe behavior	Li et al. (2017)
	Engagement	(−) action errors (−) violations	Mathisen and Bergh (2016)
	Engagement	(−) hydrocarbon leak^^^	Olsen et al. (2015)
	Job engagement	(+) safety compliance (+) safety participation	Yuan et al. (2015)
	Job satisfaction	(−) injuries (−) accidents	Siu et al. (2004)
	Job satisfaction	(ns) safety compliance	Masia and Pienaar (2011)
	Organizational commitment	(ns) safety compliance	Masia and Pienaar (2011)
Impairments	Job stress	(+) injury incident	Leung et al. (2010)
	Emotional stress	(+) injury incident	Leung et al. (2010)
	Emotional stress	(+) unsafe behaviors(ns) injury incidents	Leung et al. (2012)
	Physical stress	(+) unsafe behaviors (−) injury incidents	Leung et al. (2012)
	Physical stress	(−) safety behavior (ns) accidents	Leung et al. (2016)
	Psychological stress	(ns) safety behavior (ns) accidents	Leung et al. (2016)
	Job stress	(ns) team safety climate(ns) safety compliance (ns) safety participation	Li et al. (2019)
	Stress	(−) safety compliance(ns) safety participation	Lu and Kuo (2016)
	Stress	(−) safety compliance	Masia and Pienaar (2011)
	Stress	(+) risk taking	Rubin et al. (2020)
	Fatalism	(ns) team safety climate(ns) safety compliance (ns) safety participation	Li et al. (2019)
	Emotional exhaustion	(−) safety compliance (+) near miss(ns) injuries	Li et al. (2013)
	Emotional exhaustion	(+) action errors (+) violations	Mathisen and Bergh (2016)
	Fatigue	(−) safety behavior	Seo et al. (2015)
	Fatigue	(−) situational awareness (+) unsafe behaviors	Sneddon et al. (2013)
	Emotional exhaustion	(+) unsafe behavior	Chen and Li (2020)
	Emotional exhaustion	(+) employee unsafe behavior	Ju et al. (2016)
	Psychological detachment	(−) unsafe behavior	Chen and Li (2020)
	Psychological distress	(+) injuries (+) accidents	Siu et al. (2004)
	Job dissatisfaction	(+) risky behavior	Gracia and Martínez-Córcoles (2018)
	Safety dissatisfaction	(+) risky behavior	Gracia and Martínez-Córcoles (2018)

Abbreviations: (+/−) – positive / negative empirical association between investigated concepts. ^^^ objective (non-self-report) measurement.

work pressure (Kvalheim and Dahl, 2016), or time pressure (Rubin et al., 2020), which in turn are negatively related to safety–critical factors. And yet, it is of necessity to mark that some of the examined projects provided non-significant results (e.g., Peng and Chan, 2019). This could indicate in turn that job-induced pressure can lead to adverse safety-specific effects that are additionally dependent on, for instance, unique personal, situational, or institutional factors. Along this train of thought, Olafsen and Frølund (2018) argued that job challenges and job hindrances need to be viewed as distinct within the Job Demands-Resources model as they are differently related to individuals' basic psychological needs. On the other hand, obtained results could also indicate different reporting cultures across counties as the majority of non-significant associations between job demands and safety factors were reported in studies from Eastern Asia. However, there are still too few available studies to perform any additional analyses addressing these possible explanations. Furthermore, it is also of utmost importance to recognize that whereas the studies that form the body of this review investigated a range of organizational demands, a great number of them focused on demands associated particularly with leadership, where perception of unfair reward and treatment (e.g., Leung et al., 2012), laissez faire leadership (e.g., Sandhåland et al., 2017), distrust of managers (e.g., Conchie and Donald, 2006), and procedural vagueness (e.g., Dahl et al., 2014) were touched upon repeatedly. All except one study reported negative associations between the leadership variables and safety factors indicating that leadership is an important catalyst of safety behavior. This becomes even more evident when we look at the job resources variables where the leadership factors such as supervisor support (e.g., Li et al., 2013), Leader Member Exchange (LMX) leadership (e.g., Kath et al., 2010), and authentic leadership (e.g., Nielsen et al., 2013) were positively associated with safety behavior. As such, a leadership component exemplified through varying structures and styles appears to be of central importance in safety–critical environments. And lastly, the remaining job resources that repeatedly exert a positive effect on safety variables are particularly a co-worker support (e.g., Yuan et al., 2015), and a perceived job-control (e.g., Turner et al., 2005) and clarity (e.g., Dahl and Olsen, 2013). When taken together, a succinct remark can be made that the majority of factors studied thus far could fit into classical stress theories like the Job Demand Control Support model (Karasek and Theorell, 1990) or the Schaufeli's (2017) classification of psychosocial factors. This, in turn, implies that a great proportion of the scrutinized studies involved theoretically sound and valid psychosocial constructs. On the other hand, one should acknowledge as well that a number of possibly relevant psychosocial factors, like work-home conflict, work underload, harassment, and perception of technological and organizational changes, have not been yet introduced and systematically investigated in the context of high-risk industries. Thus, in our view addressing these major knowledge gaps will only strengthen the existing evidence ecosystem of research into 'what' and 'how' psychosocial variables relate to safety in industrial high-risk businesses.

5.1.3. *Psychosocial factors and exerted psychosocial states*

Generally speaking, our results support the proposition outlined in the Job Demands-Resources theory, which submits that perceived psychosocial work environment correlates with one's exerted psychosocial states that could be of either impairing or invigorating nature. However, our findings show that most published studies involve some form of a job demand and its association with an impairment state like job stress or exhaustion. On top of that, collected evidence demonstrates that studies of job resources are also generally linked to employees' impaired psychosocial states where, for instance, one examines the role of leadership support in mitigating workers' emotional exhaustion and/or psychological stress. Thus, it can be observed that so far scholarly endeavors in this particular domain have placed disproportionately greater weight on subjects that parallel Safety I thinking, where the focus is on impairment states (and their possible links to safety violating behaviors) rather than on motivational states like one's engagement and job satisfaction.

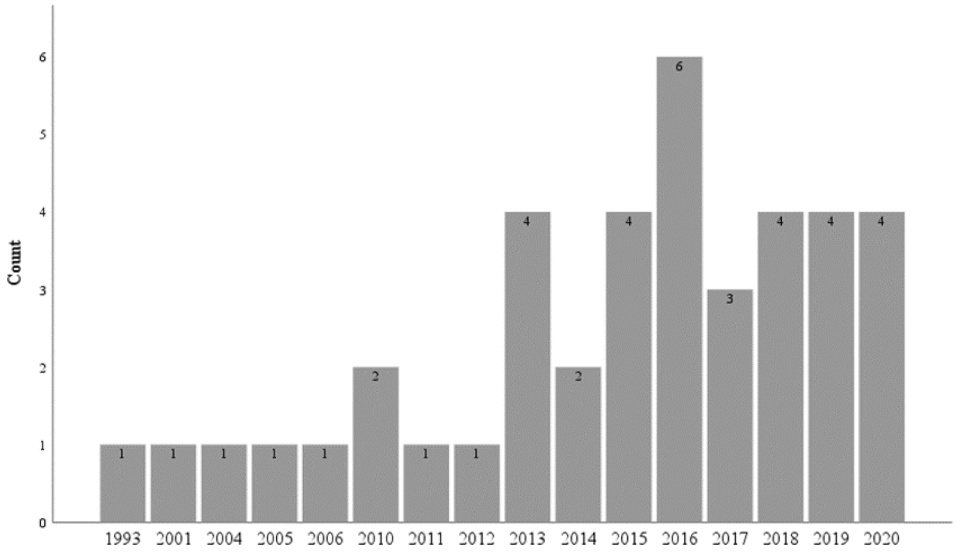

Fig. 5. Number of studies by year of publication.

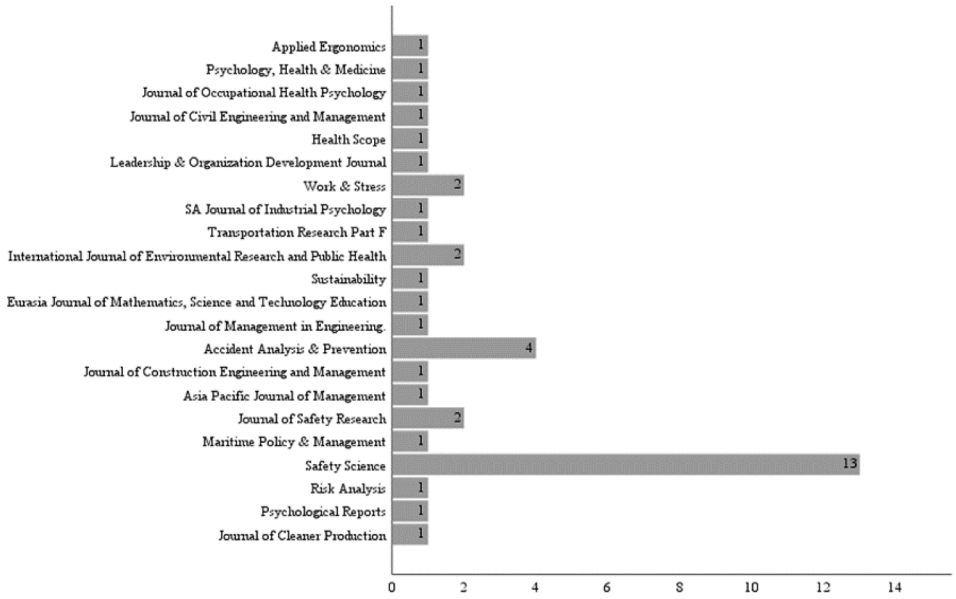

Fig. 6. Overview of peer-reviewed journals included in the sample.

Overall, the accumulated evidence indicates that job demand factors (e.g., overload, ambiguity, conflict) are likely to trigger individuals' health-impairing mental/physical conditions (e.g., emotional exhaustion). Even though this observation could be expected as it stays in line with the JD-R theory and a great body of empirical research from diverse (non-high-risk) sectors, it is crucial to pinpoint as well that these gradually unfolding mental states are often in relation with one's safety performance. For instance, the results of Wu et al. (2018) indicate the existence of negative associations between experienced job stress and a construction laborer's safety compliance and participation while on site. However, whereas the aforesaid arguments are theoretically sound and clear-cut, the link between job resources and ensuing impairments appears to be more ambiguous. For instance, next to several non-significant findings (i.e., 31 % across identified parameters) Leung et al. (2016) provides a rather counterintuitive finding for a positive association between a supervisory support and one's experienced psychological stress. This could indicate that the diminishing psychosocial work factors have more pronounced effects and power over the positive work factors in the same manner in the high-risk work sector as for other walks of life where the "bad is stronger than good"(Baumeister et al., 2001). Still, caution should be exercised in this regard (due to a limited number of studies) when attempting to draw any definitive conclusions in this direction. A comprehensive understanding of this topic would require from future studies to untangle the linkages between psychosocial factors and many possibly relevant exerted psychological states that haven't been fully investigated yet in the high-risk sector, like for instance boredom, sleep problems, job engagement, and job satisfaction.

5.1.4. Exerted psychosocial states and safety factors

Broadly, within the confines of this systematic literature review the great majority of studies have explored the associations between negatively laden exerted psychosocial states and safety. Specifically, scrutinized studies mainly documented associations between different forms of stress and/or emotional exhaustion and safety outcomes (e.g., Masia and Pienaar, 2011; Mathisen and Bergh, 2016). However, it is crucial to note as well that several investigations reported non-significant effects,

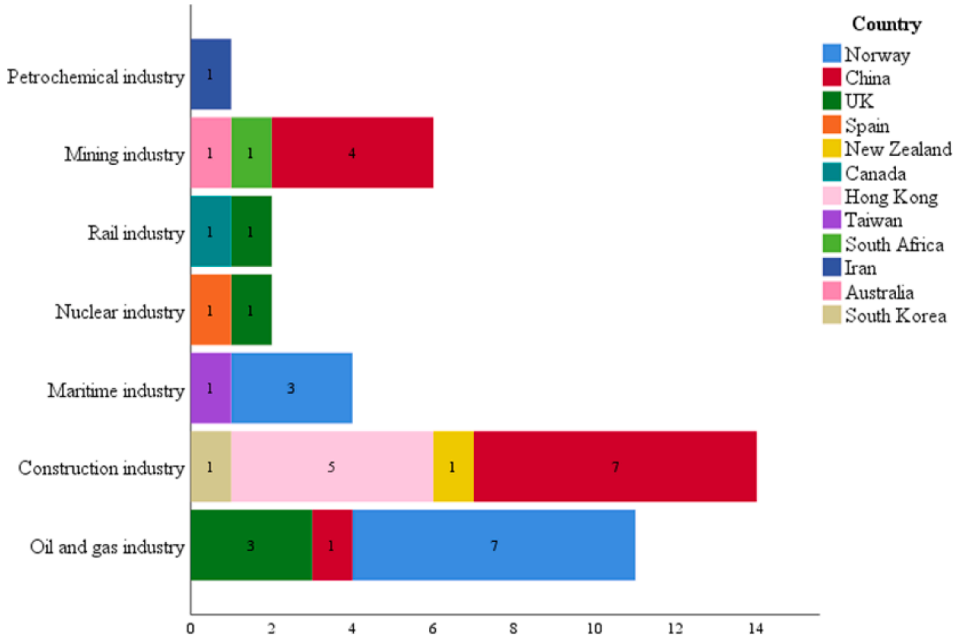

Fig. 7. Countries of origin of selected studies with specific high-risk industries enlisted.

which may signal the existence of situations when and where the adverse psychosocial states are particularly troublesome. For instance, it has been argued that devised and tested models in this domain are overly simplistic as they often fail to account for plausible interaction effects between several negative elements such as emotional and physical job stress, and life stressors (e.g., Hammer and Sauter, 2013). Moreover, in our view the differential effects of impairing psychosocial states on various forms of safety (mis)behaviors and ensuing safety outcomes are yet to be explored. And to take this reasoning a step further, one should consider as well the potential impact of dynamic stress spirals (Hobfoll et al., 2018) that in an iterative fashion severely deplete people's resources and as such contribute to greater work stress and in consequence affect, for instance, safety-specific behaviors (e.g., Halbesleben, 2010). Further, only five studies in our sample investigated the ameliorating effects of positively laden exerted psychosocial states, such as job engagement and job satisfaction. Here, all except from two of those projects explored the effect of positively laden states on negatively framed safety outcomes such as unsafe behavior and action errors. Thus, by far the main emphasis in the literature has been on questions that resemble the Safety I thinking, and in our view the field could benefit from a stronger focus on investigating which psychosocial states are most common when everything "goes right". That is, to turn around the attention from safety deteriorating- to safety promoting psychosocial states (i.e., Safety II thinking) so as to capture the complexity and variety of relationships between work-induced psychosocial states and safety.

5.2. *Pathways to expanding the conceptual framework*

According to Miles and Huberman (1984, p. 33), a conceptual framework represents "the current version of the researcher's map of the territory being investigated". Implicit in their notion is that conceptual frameworks evolve as researchers accumulate new evidence over time. As such, paragraphs that follow discuss a few perspectives on how to expand the proposed conceptual frame (Fig. 3) given the obtained results. Provided ideas, needless to say, are not intended to be exhaustive but rather to signal some of the opportunities that in our view can generate novel findings.

From the outset, a word of caution needs to be noted on the quality of causal inferences in the examined publications. At the theoretical level, the JD-R model clearly postulates casual relations between workplace psychosocial features, exerted psychosocial states, and the outcomes of scholarly interest. Yet, collected empirical evidence that repeatedly relies on correlational, cross-sectional self-reported data (with a few exceptions, e.g., Cohen et al. (2016); Olsen et al. (2015)) points to the idea that despite all the efforts we cannot completely rule out from our framework the possibility of *reciprocal causality*. As an example, Xanthopoulou et al. (2009) examined reciprocal relationships between job resources, personal resources, and work engagement. Thus, to strengthen the theoretically sound causal arguments that are not completely validated on empirical grounds, a greater variation in research designs and data collection methods should be acknowledged in future studies. As an example, one may wish to follow the footsteps of Olsen et al. (2015) and Cohen et al. (2016) who in their well-designed inquiries adopted longitudinal and experimental designs, respectively. Alternatively, one may also take into account the possibility of adopting data collection techniques based on the latest advancements in unobtrusive innovative technologies such as, for instance, wearable sensors (Knight, 2018). In a similar vein, digital app diaries that record instantaneous, daily, or weekly fluctuations in one's perception of psychosocial work environment and the ensuing emergent psychosocial states, and safety behavior would lay a solid foundation for carefully calibrated causal statements.

Once the causality dimension of our framework receives further empirical support, the field needs to finally enter what Fergnani and Chermack (2021) call the fourth stage of theoretical development, which involves the formulation and testing of *moderated and mediated* hypotheses. Our review reveals that the majority of studies conducted to date rely on diverse variations of Hackman's (1987) 'input-process-output' (I-P-O) model to explain submitted causal/sequential/directional lines of reasoning. To illustrate, Sneddon et al. (2013) present a sequential course of action where higher levels of stress and fatigue (i.e., inputs) are linked to lower levels of work situation awareness (i.e., process), which in turn are indicative of increased participation in unsafe work behaviors, and higher accident risk (i.e., outputs) among offshore drilling crews. Although we do maintain that existing findings, which rest on this linear narrative, are cumulatively useful, we do insist as well upon a greater articulation of more sophisticated problems in the future. Bakker and Demerouti (2017) have long asserted that an employee's job resources can act as a buffer (i.e., a moderator as illustrated in our framework) between experienced psychosocial hazards and

succeeding safety-focused (mis)behaviors, and yet it has only been Wang et al. (2018, 2020) and Lu and Kuo (2016) who empirically tested the robustness of this rationale in the context of high-risk industries.

With the passage of time as the work on psychosocial factors in high-risk industries reaches scientific maturity, future scholarly endeavors should consider expanding our conceptual framework by incorporating *dynamic properties* into one's models. According to Cronin and Vancouver (2019), to theorize about truly dynamic processes four critical properties should ultimately be integrated into conceptual modeling. These are (a) inertia, (b) feedback loops, (c) potential asymmetric influences, and (d) endogenous change. To date, only a handful of studies have assessed, for instance, how experienced injuries or accidents affect one's perception of the psychosocial work environment (i.e., a 'feedback loop' (Kongsvik et al., 2011)) and safety-related feelings and cognitions. And although Khanzode et al. (2012) articulate in their literature review the importance of comprehending feedback effects in safety–critical environments (as they say: "Liability towards accident is also influenced by previous accident experience" (p. 1359)), our theoretical and empirical understanding of dynamics within the field remains nascent. To gain momentum on this front, one may in our view begin with distinguishing between the short- and long-term effects the diverse psychosocial factors have on emerging psychosocial states, and safety variables. It is within reason to think of an employee's burnout as a mental condition that is health-impairing and long-lasting (i.e., chronic), whereas increased situational awareness can be regarded as being health-attaining and short-lived (i.e., episodic). Most likely the psychosocial factors that have episodic or short time effects do not completely parallel psychosocial factors that exert long term effects. For instance, we may assume that the psychosocial factors like emotional conflicts and workload impair one's situational awareness (e.g., Sneddon et al., 2006), whereas role ambiguity detriments one's well-being over time (no identified studies from high-risk industries). Be that as it may, we do recognize operational challenges associated with undertaking studies that would test dynamic models. Longitudinal designs, for instance, with multiple, repeated measures are often costly, time-consuming, and difficult to procure. On top of that, extracted data may require sophisticated statistical procedures that would incorporate, for example, latent changes over time. Fortunately, new techniques are being developed as we speak to accommodate these complexities (e.g., Hamaker and Wichers, 2017; Humphrey and Aime, 2014).

Finally, the great majority of the reviewed studies designed, conceptualized, collected and analyzed data taken from an individual level perspective, and generally did not reflect on issues associated with *multilevel or cross-level* modeling. Naturally, whereas some of the applied psychosocial constructs could be conceptualized as individual level variables (e.g., perceived role clarity), others could possibly be better off when defined as team or department level variables (e.g., psychological safety in the team). The same rationale applies to safety output variables. That is, safety output could be seen as an individual level phenomenon (e.g., individual safety compliance), a team level phenomenon (e.g., safety climate), or even an installation level phenomenon (e.g., gas leakage and explosion at an offshore oil rig). And although Bakker and Demerouti' (2017) JD-R theory has been formulated in a way to accommodate the multilevel nature of a workplace environment, our results reveal no studies that would adopt this particular view in the context of high-risk industries. In this regard, we are of the opinion that in order to capture the complexity of psychosocial factors/safety phenomena and develop more sophisticated conceptual frameworks than the one presented in this study, integrating multilevel constructs is absolutely essential. This can be achieved not only by introducing to the model predictors or outcomes from another level, but also by testing whether constructs maintain their meaning across levels of analysis (i.e., isomorphism (Tay et al., 2014)), or whether X-Y relationships observed at one level are comparable to those recorded between similar variables at different level of analysis (i.e., homology (Chen et al., 2005)). From a practical point of view, knowledge gathered by following a multilevel approach can support the development of effective interventions. For instance, this approach makes it possible to evaluate to what extent individuals' perceptions of psychosocial work environment and safety are shared among team members. If the majority of a team uniformly reports a heavy workload, this should be addressed as a team level issue. On the other hand, if there is a low level of agreement regarding perceived levels of a workload, other systematic differences could be analyzed, for instance related to demographic variables or job roles (Klein and Kozlowski, 2000).

Taken together, our propositions to extend the submitted conceptual framework invite future studies to consider reciprocal associations between variables, to introduce a range of moderators and mediators as well as dynamic properties into one's models, and lastly to advance the multilevel reasoning so as to capture more realistic models of psychosocial workplace environment and safety. These attempts will not only push the intellectual boundaries of our knowledge on the topic in the context of high-risk industries, but also provide further support for the argument that safety outcomes such as action errors cannot solely be attributed to individual factors, but rather to interactions between different components in the framework. A perspective that corresponds well with contemporary views on 'human error' research, which implies that safety outcomes are embedded in complex systems and emerge from interactions and relationships between multiple components with different patterns of cause and effect (Read et al 2021).

5.3. *Some further avenues of inquiry*

Apart from the pinpointed avenues for future research described in previous sections, our findings reveal some further aspects that in our view deserve scholarly attention. These concerns are of both theoretical and methodological nature.

5.3.1. *Swamps of conceptual vagueness*

The theoretical language in the field of psychology is often viewed as full of fuzzy concepts and similar but not identical definitions of terms, which in general is a shortcoming widely recognized and frequently debated upon throughout the decades (Behling, 1978; Zagaria et al., 2020). To exemplify the problem in the context of this investigation, one may look at the concept of 'control at work'. While Leung et al. (2016) examined the idea of 'job control', Peng and Chan (2019) focused on the 'behavioral control' phenomenon, and further Ju et al. (2016) investigated the role of 'personal control' at work. Similarly, the same issue pertains to the exerted psychosocial states as there is no clear-cut distinction between concepts like, for example, stress (Yu and Li, 2020), job stress (Li et al., 2019), psychological stress (Leung et al., 2016), and emotional stress (Leung et al., 2010). As these constructs possibly overlap (which as such hampers a theory and practice development), our argument echoes the sentiment of scholars who have called for greater semantic clarity and consistency in the field of psychology, which could be achieved through, e.g., the establishment of a shared psychological lexicon (Mascolo, 2021).

In a related vein, we are of the view that there is a need for clearer specification and classification of psychosocial factors that belong to the two broadly defined Demands and Resources phenomena in the JD-R model. Without any further specification, we may boldly assert that all positive and negative factors experienced at work (and also outside of it) can be comprehended as psychosocial concepts as long as they are relevant to the people who work there. Again, to advance the strand of research on associations between psychosocial workplace features and safety in high-risk businesses, one should attempt to develop a nomological network of thematically related concepts that fall under the psychosocial umbrella. A starting point in this endeavor could be the Schaufeli's (2017) classification of Job Demands-Resources that we applied to this project, which further on could be refined, extended, and/or tailored to the specific setting in line with existing generic theoretical guidelines (see, e.g., Niknazar and Bourgault, 2017).

5.3.2. Neglect of measurements quality

An English statistician Doug Altman once said: "Every-one is so busy doing research they don't have time to stop and think about the *way* they're doing it" (after Epstein, 2021, p. 51). Whereas this general methodological critique could certainly be associated with issues pertaining, for instance, to inadequate sampling strategies, or incorrect statistical applications, a cause for concern in our eyes exists as we look closer at the quality of measurements employed in scrutinized studies. Toomela (2008) asserted that "Results of any kind of statistical data analysis can be theoretically meaningfully interpreted if and only if information encoded in variables is unambiguously defined" (p. 252). To merely signal the problem, our work reveals that it is not uncommon among researchers to apply 'double-barreled' measures, where several referents of interest are cramped into a single scale. For instance, while Liang et al. (2018) intended to examine the phenomenon of 'perceived social support' at work, their sampled items referred to both management and coworkers under the same measurement (i.e., "*Management* can always deal with the safety issues reported by workers in a timely manner", and "There is frequent communication about safety issues within our *workgroup*"). The problem occurs when one receives social support only from, e.g., coworkers, but not from the upper management itself. Under this condition, recorded data are likely to be featured by a systematic error and so deliver a rather distorted picture of, in this instance, a perception of available social support at work. Thus, in our view upcoming scholarly endeavors should prioritize and establish rigid measuring procedures that will allow us to consistently capture, evaluate and replicate the findings related to phenomena of one's interest.

5.3.3. New ways of working

Nowadays, digital technologies are rapidly and broadly transforming our economies and societies (Nowotny, 2021), and the labor market is of no exception (Daugherty and Wilson, 2018). In this light, our last suggestion refers to the problem of employees' perceptions that are associated with new modes of working that could potentially trigger the emergence of novel psychosocial factors in the context of high-risk industries. Essentially, there is a lack of any knowledge on the effects of digitalization and intelligent automation (through artificial intelligence [AI]) on emerging psychosocial states and safety behavior. Despite the fact that digital technologies are now providing several critical and essential services to high-risk industries, there are no studies that would touch upon their psychosocial consequences for employees. According to Dauvergne (2020), leading oil and gas as well as mining companies are now heavily investing in artificial intelligence to accelerate their production and in consequence seize their growth and profit opportunities. These developments will (or already have) fundamentally change how the work is performed. For instance, the changes reshape the information workers have access to (e.g., real time data), increase flexibility regarding where work is done (e.g., integrated operations), and alter collaboration patterns (e.g., interaction with robots) (Parker and Grote, 2020). Yet, despite these immediate advantages, recent psychological research has also given prominence to, for instance, issues associated with individuals' artificial intelligence anxiety (Li and Huang, 2020), which is a problem that presumably will affect psychosocial working conditions in a number of industries in the foreseeable future (Moore, 2019). Thus, one may speculate that these rather inevitable changes may have both positive and more challenging implications for health and safety in high-risk industries that need to be thoroughly addressed.

5.4. Practical implications

It is interesting to note that even though the knowledge related to psychosocial risk factors and safety outcomes has progressively increased over the last 20 years, reports still point out a need for stronger focus on these issues in organizations (EU-OSHA, 2019). In the most recent ESENER report (EU-OSHA, 2019)) not more than 77 % of the European establishments report that they carry out HSE risk assessments. This represents a threat to organizations' ability to prevent emerging negative psychosocial states and safety outputs because of psychosocial risks. Some of the frequently reported hindrances for performing risk assessments are that the necessary expertise is lacking and that the procedure is too burdensome. These findings indicate that there is a need for developing risk assessment methodologies that are suitable for business practices. Some tools are already available to assess and manage work environmental factors to prevent the development of work stress. An example is the Psychosocial Risk Management Excellence Framework (PRIMA-EF), funded by the European Commission's Sixth Framework Programme (Leka et al., 2008). Already existing tools could be adapted and simplified to better meet business context needs and competence. Moreover, intervention strategies to mitigate the psychosocial risks are still needed in the high-risk industry. Mathisen et al. (2017) described the development and implementation of a psychosocial risk management tool tailored to the needs of the oil and gas industry that could serve as inspiration for further initiatives.

5.5. Limitations of the current review

Like most of the research, this study is subject to certain imperfections. First, although we applied predefined methodological quality evaluation criteria with numerical values to help us decide which articles to include in the review, this evaluation was still partly a subjective process as there is no clear consensus on quantitative in general, and methodological in particular, reporting standards in social sciences. Thus, we cannot rule out the possibility that other scholars would include fewer or, in contrary, greater number of articles. This is however a limitation that in our view can be recognized in most review studies where authors make educated (yet not completely standardized) choices regarding, e.g., inclusion/exclusion criteria, selection of bibliographic databases, or quality appraisal tools. Moreover, although the included articles do of course differ in their methodological qualities, we refrained from providing information about each article's "score" as our intention was not to criticize the work of fellow researchers. This decision was dictated by the ethical consideration that reducing the substance of an article to a single metric would be overly simplistic and would not do justice to the authors' invested efforts and more general contributions. Second, when collecting and synthesizing existing peer-reviewed publications on a given topic, one can never eliminate the risk, and account for the effect, of publication bias. Whereas there is strong evidence that publication bias exists in scientific peer-reviewed writings (Dickersin, 2008), there are still a handful of methods for detecting and addressing its impact on a literature review's results (Gough et al., 2017). Indeed, when working with quantitative inquiries (as is the case for this study) one may consider devising the 'funnel plot' where gathered effect sizes (from included publications) are plotted against a measure of variance (usually the standard error), yet this approach has been argued to be suitable primarily for meta-analytical investigations that in principle focus on strictly and narrowly predefined constructs and research questions (Sterne and Harbord, 2004). Be that as it may, one should recognize as well that in the context of this investigation many of the estimates presented in Tables 2–4 do not demonstrate statistical significance. While this does not apparently rule out the potential presence of publication bias from submitted results, it offers a somewhat balanced picture of the strength of associations between psychosocial factors, exerted psychosocial states, and safety outcomes. Third, in the process of searching, screening, and distilling the studies that met all the prespecified inclusion criteria, some of the qualitative studies were decisively excluded from further stages of this inquiry. Admittedly, scholarly projects that adopt a qualitative approach for scrutinizing associations between work-induced psychosocial factors and safety in high-risk industries oftentimes offer a rich and insightful body of evidence (e.g., Loosemore, 1998). Yet, due to their unique ontological and epistemological foundations, which imply a holistic

scholarly perspective where an accurate understanding of an event, a situation or an outcome is contextual, idiosyncratic and time bound (Astin and Long, 2014; Lakshman et al., 2000), drawing any meaningful comparisons of the results across the publications (that would be both qualitative and quantitative in core) would appear superficial, and therefore be of a dubious quality. Besides, scholars admit that methods for synthesizing qualitative and quantitative evidence ecosystems remain under-developed and under-evaluated (Dixon-Woods et al., 2005). And lastly, one needs to admit that whilst several strategies were employed to reduce the odds of missing out studies that would be relevant to meet the purpose of this systematic review (i.e., systematic searching protocol devised; four bibliographical databases used; forward and backward citation checks performed), the chance that a study was omitted cannot completely be excluded.

6. Conclusion

Catastrophic events, smaller-scale accidents, injuries, near-misses, or unsafe behaviors in high-risk industries are made possible by failures resulting from interactions between people, processes, and equipment. Although psychosocial work characteristics have been recognized as critical across sectors their role deserves greater attention especially across high-risk industries, where the body of research is gradually expanding and the need for its synthesis has been embraced in both professional and academic environments. As illustrated by this study, substantial intellectual investments are yet to be undertaken to reach a holistic understanding of these aspects in the context of high-risk industries. Yet, we argue that the existent body of research constitutes an important and necessary steppingstone in the journey towards a more unified understanding of the complex interplay between psychosocial factors and safety in high-risk industries. To facilitate this endeavor, the current systematic review (a) offers arguments for extending the widely acknowledged theoretical JD-R model, (b) delineates thematic trends in scrutinized literature, (c) reveals gaps and meaningful directions for future research, and (d) provides some practical implications for professionals operating in high-risk industries.

CRediT authorship contribution statement

Lukasz Andrzej Derdowski: Conceptualization, Methodology, Formal analysis, Resources, Writing - original draft, Writing - review & editing, Visualization, Project administration. **Gro Ellen Mathisen:** Conceptualization, Formal analysis, Resources, Writing - original draft, Writing - review & editing, Project administration, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Methodological quality appraisal checklist for quantitative studies

Methodological quality appraisal checklist for quantitative studies.
Reviewer: Date:
Study under appraisal:

	Very well (3)	Well (2)	Acceptable (1)	Bad (0)	Unclear	Not applicable
1. Is the sampling strategy clearly described?	☐	☐	☐	☐	☐	☐
2. Is the sampling strategy relevant to address the research question?	☐	☐	☐	☐	☐	☐
3. Is the sample representative of the target population?	☐	☐	☐	☐	☐	☐
4. Is the sample large enough for conducted statistical analysis?	☐	☐	☐	☐	☐	☐
5. Is the study setting clearly described?	☐	☐	☐	☐	☐	☐
6. Are the measurements of IVs and DVs appropriate?	☐	☐	☐	☐	☐	☐
7. Are the statistical tests used to analyze the data clearly described?	☐	☐	☐	☐	☐	☐
8. Is the statistical analysis appropriate to answer the research question?	☐	☐	☐	☐	☐	☐

Overall appraisal: … pts.
Include ☐ Exclude ☐ Seek further info ☐.
Comments (Including reasons for exclusion): …….

Appendix B. Final pool of articles included in the review that satisfied all inclusion and exclusion criteria as well as the methodological quality appraisal

Bergh, L. I. V., Ringstad, A. J., Leka, S., & Zwetsloot, G. I. (2014). Psychosocial risks and hydrocarbon leaks: an exploration of their relationship in the Norwegian oil and gas industry. *Journal of Cleaner Production*, 84, 824-830.
Chen, Y., & Li, S. (2020). Relationship between workplace ostracism and unsafe behaviors: The mediating effect of psychological detachment and emotional exhaustion. *Psychological Reports*, 123(2), 488-516.
Conchie, S. M., & Donald, I. J. (2006). The role of distrust in offshore safety performance. *Risk Analysis*, 26(5), 1151-1159. doi:10.1111/j.1539-6924.2006.00822.x1.
Dahl, Ø., & Olsen, E. (2013). Safety compliance on offshore platforms: A multi-sample survey on the role of perceived leadership involvement and work climate. *Safety Science*, 54, 17-26.
Dahl, Ø., Fenstad, J., & Kongsvik, T. (2014). Antecedents of safety-compliant behaviour on offshore service vessels: a multi-factorial approach. *Maritime Policy & Management*, 41(1), 20-41.
Dahl, O., & Kongsvik, T. (2018). Safety climate and mindful safety practices in the oil and gas industry. *Journal of Safety Research*, 64, 29-36. doi:10.1016/j.jsr.2017.12.009.
Gracia, F. J., & Martínez-Córcoles, M. (2018). Understanding risky behaviours in nuclear facilities: the impact of role stressors. *Safety Science*, 104, 135-143.

Guo, B. H., Yiu, T. W., & Gonzalez, V. A. (2016). Predicting safety behavior in the construction industry: Development and test of an integrative model. *Safety Science*, 84, 1-11. doi:https://doi.org/10.1016/j.ssci.2015.11.020.
Ju, D., Qin, X., Xu, M., & DiRenzo, M. S. (2016). Boundary conditions of the emotional exhaustion-unsafe behavior link: The dark side of group norms and personal control. *Asia Pacific Journal of Management*, 33(1), 113-140.
Kath, L. M., Marks, K. M., & Ranney, J. (2010). Safety climate dimensions, leader–member exchange, and organizational support as predictors of upward safety communication in a sample of rail industry workers. *Safety Science*, 48(5), 643-650.
Kvalheim, S. A., & Dahl, O. (2016). Safety compliance and safety climate: A repeated cross-sectional study in the oil and gas industry. *Journal of Safety Research*, 59, 33-41. doi:https://doi.org/10.1016/j.jsr.2016.10.006.
Leung, M. Y., Chan, Y. S., & Yuen, K. W. (2010). Impacts of stressors and stress on the injury incidents of construction workers in Hong Kong. *Journal of Construction Engineering and Management*, 136(10), 1093–1103.
Leung, M.-y., Chan, I. Y. S., & Yu, J. (2012). Preventing construction worker injury incidents through the management of personal stress and organizational stressors. *Accident Analysis & Prevention*, 48, 156-166.
Leung, M.Y.; Liang, Q.; Olomolaiye, P. (2016). Impact of job stressors and stress on the safety behavior and accidents of construction workers. *Journal of Management in Engineering*, 32(1), 04015019.
Li, F., Jiang, L., Yao, X., & Li, Y. (2013). Job demands, job resources and safety outcomes: The roles of emotional exhaustion and safety compliance. *Accident Analysis & Prevention*, 51, 243–251.
Li, J. Z., Zhang, Y. P., Wang, X. J., Feng, G. R., Zhang, B. S., Wang, T. R., ... & Qu, J. J. (2017). Relationship research between subjective well-being and unsafe behavior of coal miners. *Eurasia Journal of Mathematics, Science and Technology Education*, 13(11), 7215-7221.
Li, Y., Wu, X., Luo, X., Gao, J., & Yin, W. (2019). Impact of safety attitude on the safety behavior of coal miners in China. *Sustainability*, 11(22), 6382.
Liang, H., & Zhang, S. (2019). Impact of supervisors' safety violations on an individual worker within a construction crew. *Safety Science*, 120, 679-691.
Liang, H., Lin, K. Y., Zhang, S., & Su, Y. (2018). The impact of coworkers' safety violations on an individual worker: A social contagion effect within the construction crew. *International Journal of Environmental Research and Public Health*, 15(4). doi:10.3390/ijerph15040773.
Lu, C.-S., & Kuo, S.-Y. (2016). The effect of job stress on self-reported safety behaviour in container terminal operations: The moderating role of emotional intelligence. *Transportation Research part F: Traffic Psychology and Behaviour*, 37, 10-26.
Masia, U., & Pienaar, J. (2011). Unravelling safety compliance in the mining industry: examining the role of work stress, job insecurity, satisfaction and commitment as antecedents. *SA Journal of Industrial Psychology*, 37, 01–10.
Mathisen, G. E., & Bergh, L. I. V. (2016). Action errors and rule violations at offshore oil rigs: The role of engagement, emotional exhaustion and health complaints. *Safety Science*, 85, 130-138.
Mearns, K., Flin, R., Gordon, R., Fleming, M., 2001. Human and organizational factors in offshore safety. *Work Stress*, 15, 144–160.
Nielsen, M. B., Eid, J., Mearns, K., & Larsson, G. (2013). Authentic leadership and its relationship with risk perception and safety climate. *Leadership & Organization Development Journal*, vol. 34 No. 4, pp. 308-325. https://doi.org/10.1108/LODJ-07-2011-0065.
Olsen, E., Næss, S., & Høyland, S. (2015). Exploring relationships between organizational factors and hydrocarbon leaks on offshore platform. *Safety Science*, 80, 301-309.
Peng, L., & Chan, A. H. (2019). Exerting explanatory accounts of safety behavior of older construction workers within the theory of planned behavior. *International Journal of Environmental Research and Public Health*, 16(18), 3342.
Pordanjani, T. R., & Ebrahimi, A. M. (2015). Safety Motivation and Work Pressure as Predictors of Occupational Accidents in the Petrochemical Industry. *Health Scope*, 4(4).
Rubin, M., Giacomini, A., Allen, R., Turner, R., & Kelly, B. (2020). Identifying safety culture and safety climate variables that predict reported risk-taking among Australian coal miners: An exploratory longitudinal study. *Safety Science*, 123, 104564.
Sætrevik, B., & Hystad, S. W. (2017). Situation awareness as a determinant for unsafe actions and subjective risk assessment on offshore attendant vessels. *Safety Science*, 93, 214-221.
Sandhåland, H., Oltedal, H. A., Hystad, S. W., & Eid, J. (2017). Effects of leadership style and psychological job demands on situation awareness and the willingness to take a risk: A survey of selected offshore vessels. *Safety Science*, 93, 178-186.
Seo, H.C., Lee, Y.S., Kim, J.J., Jee, N.Y. (2015). Analyzing safety behaviors of temporary construction workers using structural equation modeling. *Safety Science*, 77, 160–168.
Siu, O., Phillips, D.R., Leung, T. (2004). Safety climate and safety performance among construction workers in Hong Kong: the role of psychological strains as mediators. *Accident Analysis & Prevention*, 36 (3), 359–366.
Smith, L., & Folkard, S. (1993). The impact of shiftwork on personnel at a nuclear power plant: An exploratory survey study. *Work & Stress*, 7(4), 341-350. doi:10.1080/02678379308257073
Sneddon, A., Mearns, K., & Flin, R. (2013). Stress, fatigue, situation awareness and safety in offshore drilling crews. *Safety Science*, 56, 80-88. doi:10.1016/j.ssci.2012.05.027
Su, Y., Cong, W., & Liang, H. (2019). The impact of supervisor–worker relationship on workers' safety violations: a modified theory of planned behaviour. *Journal of Civil Engineering and Management*, 25(7), 631-645.
Turner, N., Chmiel, N., & Walls, M. (2005). Railing for safety: job demands, job control, and safety citizenship role definition. *Journal of Occupational Health Psychology*, 10(4), 504.
Wang, D.; Wang, X.Q.; Xia, N.N. (2018). How safety-related stress affects workers' safety behavior: The moderating role of psychological capital. *Safety Science*, 103, 247–259.
Wang, D., Wang, X., Griffin, M. A., & Wang, Z. (2020). Safety stressors, safety-specific trust, and safety citizenship behavior: A contingency perspective. *Accident Analysis & Prevention*, 142, 105572.
Yu, M., & Li, J. (2020). Psychosocial safety climate and unsafe behavior among miners in China: the mediating role of work stress and job burnout. *Psychology, Health & Medicine*, 25(7), 793-801.
Yuan, Z., Li, Y., & Tetrick, L. E. (2015). Job hindrances, job resources, and safety performance: The mediating role of job engagement. *Applied Ergonomics*, 51, 163-171.

References

Alper, S.J., Karsh, B.-T., 2009. A systematic review of safety violations in industry. Accid. Anal. Prev. 41 (4), 739–754.

Astin, F., Long, A., 2014. Characteristics of qualitative research and its application. Br. J. Card. Nurs. 9 (2), 93–98. https://doi.org/10.12968/bjca.2014.9.2.93.

Atkinson, K.M., Koenka, A.C., Sanchez, C.E., Moshontz, H., Cooper, H., 2015. Reporting standards for literature searches and report inclusion criteria: making research syntheses more transparent and easy to replicate. Res. Synth. Methods 6 (1), 87–95.

Bakker, A.B., Demerouti, E., 2007. The job demands-resources model: state of the art. J. Manag. Psychol.

Bakker, A.B., Demerouti, E., 2017. Job demands–resources theory: taking stock and looking forward. J. Occup. Health Psychol. 22 (3), 273.

Bakker, A.B., Demerouti, E., 2018. Multiple levels in job demands-resources theory: implications for employee well-being and performance. In: Diener, E., Oishi, S., Tay, L. (Eds.), Handbook of Well-being. Noba Scholar.

Baumeister, R.F., Bratslavsky, E., Finkenauer, C., Vohs, K.D., 2001. Bad is stronger than good. Rev. Gen. Psychol. 5 (4), 323–370. https://doi.org/10.1037/1089-2680.5.4.323.

Behling, O., 1978. Some problems in the philosophy of science of organizations. Acad. Manag. Rev. 3 (2), 193–201. https://doi.org/10.5465/amr.1978.4294841.

Bergh, L.I.V., Hinna, S., Leka, S., Jain, A., 2014. Developing a performance indicator for psychosocial risk in the oil and gas industry. Saf. Sci. 62, 98–106.

Beus, J.M., McCord, M.A., Zohar, D., 2016. Workplace safety: a review and research synthesis. Organiz. Psychol. Rev. 6 (4), 352–381. https://doi.org/10.1177/2041386615626243.

British Standards Institution (BSI), 2011. PAS1010: guidance on the management of psychosocial risks in the workplace. Retrieved from London.

Carroll, J.S., 1995. Incident reviews in high-hazard industries: sense making and learning under ambiguity and accountability. Ind. Environ. Crisis Q. 9 (2), 175–197.

Chen, G., Bliese, P.D., Mathieu, J.E., 2005. Conceptual framework and statistical procedures for delineating and testing multilevel theories of homology. Organiz. Res. Methods 8 (4), 375–409. https://doi.org/10.1177/1094428105280056.

Chirico, F., 2016. Job stress models for predicting burnout syndrome: a review. Annali dell'Istituto superiore di sanita 52 (3), 443–456.

Choudhry, R.M., Fang, D., 2008. Why operatives engage in unsafe work behavior: investigating factors on construction sites. Saf. Sci. 46 (4), 566–584.

Christian, M.S., Bradley, J.C., Wallace, J.C., Burke, M.J., 2009. Workplace safety: a meta-analysis of the roles of person and situation factors. J. Appl. Pssychol. 94 (5), 1103.

Cohen, I., den Braber, N., Smets, N.J., van Diggelen, J., Brinkman, W.-P., Neerincx, M.A., 2016. Work content influences on cognitive task load, emotional state and performance during a simulated 520-days' Mars mission. Comput. Hum. Behav. 55, 642–652.

Conchie, S.M., Donald, I.J., 2006. The role of distrust in offshore safety performance. Risk Anal. 26 (5), 1151–1159.

Cornelissen, P.A., Van Hoof, J.J., De Jong, M.D., 2017. Determinants of safety outcomes and performance: a systematic literature review of research in four high-risk industries. J. Saf. Res. 62, 127–141. https://doi.org/10.1016/j.jsr.2017.06.009.

Cox, T., Griffiths, A., 2010. Work-related stress, a theoretical perspective. In: Leka, S., Houdmont, J. (Eds.), Occupational Health Psychology. Blackwell Publishing Ltd, Malden, USA, p. 31.

Cronin, M.A., Vancouver, J.B., 2019. The only constant is change: expanding theory by incorporating dynamic properties into one's models. In: Humphrey, S.E., LeBreton, J.M. (Eds.), The Handbook of Multilevel Theory, Measurement, and Analysis. American Psychological Association, Washington, DC, US, pp. 89–114.

Dahl, Ø., Fenstad, J., Kongsvik, T., 2014. Antecedents of safety-compliant behaviour on offshore service vessels: a multi-factorial approach. Maritime Policy Manage. 41 (1), 20–41. https://doi.org/10.1080/03088839.2013.780311.

Dahl, Ø., Olsen, E., 2013. Safety compliance on offshore platforms: a multi-sample survey on the role of perceived leadership involvement and work climate. Saf. Sci. 54, 17–26.

Daugherty, P.R., Wilson, H.J., 2018. Human + Machine: Reimagining Work in the Age of AI. Harvard Business Review Press.

Dauvergne, P., 2020. AI in the Wild: Sustainability in the Age of Artificial Intelligence. MIT Press.

Dekker, S., Cilliers, P., Hofmeyr, J.-H., 2011. The complexity of failure: implications of complexity theory for safety investigations. Saf. Sci. 49 (6), 939–945. https://doi.org/10.1016/j.ssci.2011.01.008.

Dickersin, K., 2008. Publication bias: recognizing the problem, understanding its origins and scope, and preventing harm. In: Rothstein, H.R., Sutton, A.J., Borenstein, M. (Eds.), Publication Bias in Meta-Analysis Prevention, Assessment and Adjustments. John Wiley & Sons Ltd, Chichester, UK, pp. 11–33.

Dixon-Woods, M., Agarwal, S., Jones, D., Young, B., Sutton, A., 2005. Synthesising qualitative and quantitative evidence: a review of possible methods. J. Health Serv. Res. Policy 10 (1), 45–53. https://doi.org/10.1177/135581960501000110.

Dollard, M.F., Shimazu, A., Nordin, R.B., Brough, P., Tuckey, M.R., 2014. The context of psychosocial factors at work in the Asia Pacific. In: Psychosocial Factors at Work in the Asia Pacific. Springer, Dordrecht, pp. 3–26.

Downes, M.J., Brennan, M.L., Williams, H.C., Dean, R.S.J.B.O. (2016). Development of a critical appraisal tool to assess the quality of cross-sectional studies (AXIS). 6(12), e011458.

Epstein, D., 2021. Range: Why Generalists Triumph in a Specialized World. Penguin.

EU-OSHA, 2019. Third European Survey of Enterprises on New and Emerging Risks (ESENER 3). Retrieved from https://osha.europa.eu/en/publications/third-european-survey-enterprises-new-and-emerging-risks-esener-3/view.

Fergnani, A., Chermack, T.J., 2021. The resistance to scientific theory in futures and foresight, and what to do about it. Fut. Foresight Sci.nce 3 (3–4), e61. https://doi.org/10.1002/ffo2.61.

Frese, M., Keith, N., 2015. Action errors, error management, and learning in organizations. Annu. Rev. Psychol. 66, 661–687.

Gough, D., Oliver, S., Thomas, J., 2017. An Introduction to Systematic Reviews, second ed. Sage, Los Angeles, London, New Delhi.

Grabowski, M., You, Z., Zhou, Z., Song, H., Steward, M., Steward, B., 2009. Human and organizational error data challenges in complex, large-scale systems. Saf. Sci. 47 (8), 1185–1194.

Hackman, J.R., 1987. The design of work teams. In: Lorsch, J.W. (Ed.), Handbook of Organizational Behavior. Prentice-Hall, Englewood Cliffs, NJ, pp. 315–342.

Halbesleben, J.R., 2010. The role of exhaustion and workarounds in predicting occupational injuries: a cross-lagged panel study of health care professionals. J. Occup. Health Psychol. 15 (1), 1–16. https://doi.org/10.1037/a0017634.

Hale, A.R., Hovden, J., 1998. Management and culture: the third age of safety. A review of approaches to organizational aspects of safety, health and environment. Occupat. Injury 145–182.

Hamaker, E.L., Wichers, M., 2017. No time like the present: discovering the hidden dynamics in intensive longitudinal data. Curr. Direct. Psychol. Sci. 26 (1), 10–15. https://doi.org/10.1177/0963721416666518.

Hammer, L.B., Sauter, S., 2013. Total worker health and work–life stress. J. Occup. Environ. Med. 55 (12), S25–S29.

Hansez, I., Chmiel, N., 2010. Safety behavior: job demands, job resources, and perceived management commitment to safety. J. Occup. Health Psychol. 15 (3), 267.

Hawkins, F.H., 1993. Human Factors in Flight. Ashgate, Aldershot, England.

Heinrich, H.W., 1941. Industrial Accident Prevention. A Scientific Approach, second ed. McGraw-Hill Book Company, Inc., New York & London.

Hobbs, A., Williamson, A., 2002. Unsafe acts and unsafe outcomes in aircraft maintenance. Ergonomics 45 (12), 866–882.

Hobfoll, S.E., Halbesleben, J., Neveu, J.-P., Westman, M., 2018. Conservation of resources in the organizational context: the reality of resources and their consequences. Ann. Rev. Organiz. Psychol. Organiz. Behav. 5, 103–128. https://doi.org/10.1146/annurev-orgpsych032117-104640.

Hofmann, D.A., Burke, M.J., Zohar, D., 2017. 100 years of occupational safety research: from basic protections and work analysis to a multilevel view of workplace safety and risk. J. Appl. Psychol. 102 (3), 375–388. https://doi.org/10.1037/apl0000114.

Hollnagel, E., 2013. A tale of two safeties. Nucl. Saf. Simulat. 4 (1), 1–9.

Hollnagel, E., 2014. Safety–I and Safety–II: The Past and Future of Safety Management, first ed. CRC Press, London, UK.

Hong, Q.N., Fàbregues, S., Bartlett, G., Boardman, F., Cargo, M., Dagenais, P., O'Cathain, A., 2018. The Mixed Methods Appraisal Tool (MMAT) version 2018 for information professionals and researchers. Educ. Inf. 34 (4), 285–291. https://doi.org/10.3233/EFI-180221.

Humphrey, S.E., Aime, F., 2014. Team microdynamics: toward an organizing approach to teamwork. Acad. Manag. Ann. 8 (1), 443–503. https://doi.org/10.5465/19416520.2014.904140.

Jarde, A., Losilla, J.-M., Vives, J.J.A.D.P., 2012. Methodological quality assessment tools of non-experimental studies: a systematic review. Anales de psicología 28 (2), 617–628. https://doi.org/10.6018/analesps.28.2.148911.

Johnson, J.V., Hall, E.M., 1988. Job strain, work place social support, and cardiovascular disease: a cross-sectional study of a random sample of the Swedish working population. Am. J. Public Health 78 (10), 1336–1342.

Ju, D., Qin, X., Xu, M., DiRenzo, M.S., 2016. Boundary conditions of the emotional exhaustion-unsafe behavior link: the dark side of group norms and personal control. Asia Pac. J. Manage. 33 (1), 113–140. https://doi.org/10.1007/s10490-015-9455-7.

Karasek Jr, R.A., 1979. Job demands, job decision latitude, and mental strain: implications for job redesign. Adm. Sci. Q. 285–308.

Karasek, R., Theorell, T., 1990. Healthy Work. Stress, Productivity and the Reconstruction of Work Life. US: Basic Books, New York.

Kath, L.M., Marks, K.M., Ranney, J., 2010. Safety climate dimensions, leader–member exchange, and organizational support as predictors of upward safety communication in a sample of rail industry workers. Saf. Sci. 48 (5), 643–650. https://doi.org/10.1016/j.ssci.2010.01.016.

Khanzode, V.V., Maiti, J., Ray, P.K., 2012. Occupational injury and accident research: a comprehensive review. Saf. Sci. 50 (5), 1355–1367.

Klein, K.J., Kozlowski, S.W., 2000. Multilevel Theory, Research, and Methods in Organizations: Foundations, Extensions, and New Directions. Jossey-Bass, San Francisco, CA, US.

Knegtering, B., Pasman, H., 2009. Safety of the process industries in the 21st century: a changing need of process safety management for a changing industry. J. Loss Prev. Process Ind. 22 (2), 162–168.

Knight, A.P., 2018. Innovations in unobtrusive methods. In: Bryman, A., Buchanan, D.A. (Eds.), Unconventional Methodology in Organization and Management Research. Oxford University Press, Oxford, UK, p. 64.

Kongsvik, T., Johnsen, S.Å.K., Sklet, S., 2011. Safety climate and hydrocarbon leaks: an empirical contribution to the leading-lagging indicator discussion. J. Loss Prev. Process Ind. 24 (4), 405–411. https://doi.org/10.1016/j.jlp.2011.02.004.

Kvalheim, S.A., Dahl, Ø., 2016. Safety compliance and safety climate: a repeated cross-sectional study in the oil and gas industry. J. Saf. Res. 59, 33–41. https://doi.org/10.1016/j.jsr.2016.10.006.

Lakshman, M., Sinha, L., Biswas, M., Charles, M., Arora, N., 2000. Quantitative vs qualitative research methods. Indian J. Pediatr. 67 (5), 369–377. https://doi.org/10.1007/BF02820690.

Laurence, D., 2005. Safety rules and regulations on mine sites–the problem and a solution. J. Saf. Res. 36 (1), 39–50.

Lawton, R., 1998. Not working to rule: understanding procedural violations at work. Saf. Sci. 28 (2), 77–95.
Leka, S., Cox, T., Zwetsloot, G., 2008. The European Framework for Psychosocial Risk Management. PRIMA-EF. I-WHO Publications, Nottingham.
Leka, S., Jain, A., Lerouge, L., 2017. Work-related psychosocial risks: key definitions and an overview of the policy context in Europe. In: Lerouge, L. (Ed.), PsychoSocial Risks in Labour and Social Security Law. Aligning Perspectives on Health, Safety and Well-Being. Springer, Cham, pp. 1–12.
Leka, S., Van Wassenhove, W., Jain, A., 2015. Is psychosocial risk prevention possible? Deconstructing common presumptions. Saf. Sci. 71, 61–67.
Leung, M.-Y., Chan, I.Y.S., Yu, J., 2012. Preventing construction worker injury incidents through the management of personal stress and organizational stressors. Accid. Anal. Prev. 48, 156–166.
Leung, M.-Y., Liang, Q., Olomolaiye, P., 2016. Impact of job stressors and stress on the safety behavior and accidents of construction workers. J. Manage. Eng. 32 (1), 04015019.
Leung, M.Y., Chan, Y.S., Yuen, K.W., 2010. Impacts of stressors and stress on the injury incidents of construction workers in Hong Kong. J. Constr. Eng. Manage. 136 (10), 1093–1103. https://doi.org/10.1061/(ASCE)CO.1943-7862.0000216.
Li, F., Jiang, L., Yao, X., Li, Y., 2013. Job demands, job resources and safety outcomes: the roles of emotional exhaustion and safety compliance. Accid. Anal. Prev. 51, 243–251.
Li, J., Huang, J.-S., 2020. Dimensions of artificial intelligence anxiety based on the integrated fear acquisition theory. Technol. Soc. 63, 101410.
Li, Y., Wu, X., Luo, X., Gao, J., Yin, W., 2019. Impact of safety attitude on the safety behavior of coal miners in China. Sustainability 11 (22), 6382. https://doi.org/10.3390/su11226382.
Liang, H., Lin, K.-Y., Zhang, S., Su, Y., 2018. The impact of coworkers' safety violations on an individual worker: a social contagion effect within the construction crew. Int. J. Environ. Res. Public Health 15 (4), 773.
Loosemore, M., 1998. Psychology of accident prevention in the construction industry. J. Manage. Eng. 14 (3), 50–56.
Lu, C.-S., Kuo, S.-Y., 2016. The effect of job stress on self-reported safety behaviour in container terminal operations: the moderating role of emotional intelligence. Transport. Res. Part F: Traffic Psychol. Behav. 37, 10–26. https://doi.org/10.1016/j.trf.2015.12.008.
Lucas, D., 1997. The causes of human error. In: Redmill, F., Rajan, J. (Eds.), Human Factors in Safety-critical Systems. Butterworth Heinemann, Oxford, England, pp. 37–65.
Mascolo, M.F., 2021. Inching toward a unified metatheory for psychology. Integr. Psychol. Behav. Sci. 55, 198–211. https://doi.org/10.1007/s12124-020-09543-2.
Masia, U., Pienaar, J., 2011. Unravelling safety compliance in the mining industry: examining the role of work stress, job insecurity, satisfaction and commitment as antecedents. SA J. Ind. Psychol. 37 (1), 01–10.
Mathisen, G.E., Bergh, L.I.V., 2016. Action errors and rule violations at offshore oil rigs: the role of engagement, emotional exhaustion and health complaints. Saf. Sci. 85, 130–138.
Mathisen, G.E., Brønnick, K., Arntzen, K.J., Bergh, L.I.V., 2017. Identifying and managing psychosocial risks during organizational restructuring: it's what you do and how you do it. Saf. Sci. 100, 20–29. https://doi.org/10.1016/j.ssci.2016.12.007.
Mearns, K., Hope, L., 2005. Health and Well-being in the Offshore Environment: The Management of Personal Health. Health and Safety Executive.
Mearns, K., Whitaker, S.M., Flin, R., 2003. Safety climate, safety management practice and safety performance in offshore environments. Saf. Sci. 41 (8), 641–680. https://doi.org/10.1016/S0925-7535(02)00011-5.
Meshkati, N., 1991. Human factors in large-scale technological systems' accidents: Three Mile Island, Bhopal, Chernobyl. Ind. Crisis Q. 5 (2), 133–154.
Miles, M.B., Huberman, A.M., 1984. Qualitative Data Analysis: A Sourcebook of New Methods. Sage Publications, London, UK.
Moore, P.V., 2019. OSH and the future of work: benefits and risks of artificial intelligence tools in workplaces. In: Paper presented at the International Conference on Human-Computer Interaction.
Neal, A., Griffin, M.A., 1997. Perceptions of safety at work: developing a model to link organizational safety climate and individual behavior. In: Paper presented at the 12th Annual Conference of the Society for Industrial and Organizational Psychology, St. Louis, MO.
Neal, A., Griffin, M.A., Hart, P.M., 2000. The impact of organizational climate on safety climate and individual behavior. Saf. Sci. 34 (1–3), 99–109.
Nielsen, M.B., Eid, J., Mearns, K., Larsson, G., 2013. Authentic leadership and its relationship with risk perception and safety climate. Leaders. Organiz. Dev. J. 34 (4), 308–325. https://doi.org/10.1108/LODJ-07-2011-0065.
Niknazar, P., Bourgault, M., 2017. Theories for classification vs. classification as theory: implications of classification and typology for the development of project management theories. Int. J. Project Manage. 35 (2), 191–203. https://doi.org/10.1016/j.ijproman.2016.11.002.
Nowotny, H., 2021. In AI We Trust. Power, Illusion and Control of Predictive Algorithms, first ed. Polity Press, Cambridge, UK.
Olafsen, A.H., Frølund, C.W., 2018. Challenge accepted! Distinguishing between challenge-and hindrance demands. J. Manag. Psychol. 33 (4/5), 345–357. https://doi.org/10.1108/JMP-04-2017-0143.
Olsen, E., Næss, S., Høyland, S., 2015. Exploring relationships between organizational factors and hydrocarbon leaks on offshore platform. Saf. Sci. 80, 301–309.
Parker, S.K., Grote, G., 2020. Automation, algorithms, and beyond: why work design matters more than ever in a digital world. Appl. Psychol. 1–45. https://doi.org/10.1111/apps.12241.
Paul, P., Maiti, J., 2005. Development and test of a sociotechnical model for accident/injury occurrences in underground coalmines. J. South Afr. Inst. Min. Metall. 105 (1), 43–53.
Peng, L., Chan, A.H., 2019. Exerting explanatory accounts of safety behavior of older construction workers within the theory of planned behavior. Int. J. Environ. Res. Public Health 16 (18), 3342. https://doi.org/10.3390/ijerph16183342.
Pillay, M., 2015. Accident causation, prevention and safety management: a review of the state-of-the-art. Proc. Manuf. 3, 1838–1845. https://doi.org/10.1016/j.promfg.2015.07.224.
Rader, T., Mann, M., Stansfield, C., Cooper, C., Sampson, M., 2014. Methods for documenting systematic review searches: a discussion of common issues. Res. Synth. Methods 5 (2), 98–115.
Read, G.J., Shorrock, S., Walker, G.H., Salmon, P.M., 2021. State of science: evolving perspectives on 'human error'. Ergonomics 64 (9), 1091–1114. https://doi.org/10.1080/00140139.2021.1953615.
Reason, J., 1990. Human Error: Cambridge University Press.
Rich, B.L., Lepine, J.A., Crawford, E.R., 2010. Job engagement: antecedents and effects on job performance. Acad. Manag. J. 53 (3), 617–635. https://doi.org/10.5465/amj.2010.51468988.
Rubin, M., Giacomini, A., Allen, R., Turner, R., Kelly, B., 2020. Identifying safety culture and safety climate variables that predict reported risk-taking among Australian coal miners: an exploratory longitudinal study. Saf. Sci. 123, 104564 https://doi.org/10.1016/j.ssci.2019.104564.
Sandhåland, H., Oltedal, H.A., Hystad, S.W., Eid, J., 2017. Effects of leadership style and psychological job demands on situation awareness and the willingness to take a risk: a survey of selected offshore vessels. Saf. Sci. 93, 178–186. https://doi.org/10.1016/j.ssci.2016.12.004.
Scharf, T., Vaught, C., Kidd, P., Steiner, L., Kowalski, K., Wiehagen, B., Cole, H., 2001. Toward a typology of dynamic and hazardous work environments. Hum. Ecol. Risk Assess. 7 (7), 1827–1841.
Schaufeli, W.B., 2017. Applying the Job Demands-Resources model: a 'how to' guide to measuring and tackling work engagement and burnout. Organiz. Dyn. 2 (46), 120–132. https://doi.org/10.1016/j.orgdyn.2017.04.008.
Schaufeli, W.B., Bakker, A.B., 2004. Job demands, job resources, and their relationship with burnout and engagement: a multi-sample study. J. Organiz. Behav.: Int. J. Ind. Occupat. Organiz. Psychol. Behav. 25 (3), 293–315.
Schaufeli, W.B., Bakker, A.B., Van Rhenen, W., 2009. How changes in job demands and resources predict burnout, work engagement, and sickness absenteeism. J. Organiz. Behav. 30 (7), 893–917.
Skalle, P., Aamodt, A., Laumann, K., 2014. Integrating human related errors with technical errors to determine causes behind offshore accidents. Saf. Sci. 63, 179–190.
Sneddon, A., Mearns, K., Flin, R., 2006. Situation awareness and safety in offshore drill crews. Cogn. Technol. Work 8 (4), 255–267.
Sneddon, A., Mearns, K., Flin, R., 2013. Stress, fatigue, situation awareness and safety in offshore drilling crews. Saf. Sci. 56, 80–88.
Snyder, H., 2019. Literature review as a research methodology: an overview and guidelines. J. Bus. Res. 104, 333–339.
Sterne, J.A., Harbord, R.M., 2004. Funnel plots in meta-analysis. Stata J. 4 (2), 127–141.
Su, Y., Cong, W., Liang, H., 2019. The impact of supervisor–worker relationship on workers' safety violations: a modified theory of planned behaviour. J. Civ. Eng. Manage. 25 (7), 631–645.
Sutherland, V.J., Cooper, C.L., 1996. Stress in the offshore oil and gas exploration and production industries: an organizational approach to stress control. Stress Med. 12 (1), 27–34.
Swuste, P., Theunissen, J., Schmitz, P., Reniers, G., Blokland, P., 2016. Process safety indicators, a review of literature. J. Loss Prev. Process Ind. 40, 162–173.
Tang, K.H.D., Dawal, S.Z.M., Olugu, E.U., 2018. A review of the offshore oil and gas safety indices. Saf. Sci. 109, 344–352.
Tay, L., Woo, S.E., Vermunt, J.K., 2014. A conceptual and methodological framework for psychometric isomorphism: validation of multilevel construct measures. Organiz. Res. Methods 17 (1), 77–106. https://doi.org/10.1177/1094428113517008.
Toomela, A., 2008. Variables in psychology: a critique of quantitative psychology. Integr. Psychol. Behav. Sci. 42, 245–265. https://doi.org/10.1007/s12124-008-9059-6.
Turner, N., Chmiel, N., Walls, M., 2005. Railing for safety: job demands, job control, and safety citizenship role definition. J. Occup. Health Psychol. 10 (4), 504–512. https://doi.org/10.1037/1076-8998.10.4.504.
Walker, K., Poore, W., Eales, M., 2012. Improving the opportunity for learning from industry safety data. In: Paper presented at the International Conference on Health, Safety and Environment in Oil and Gas Exploration and Production.
Wang, D., Wang, X., Xia, N., 2018. How safety-related stress affects workers' safety behavior: the moderating role of psychological capital. Saf. Sci. 103, 247–259. https://doi.org/10.1016/j.ssci.2017.11.020.
Wu, X., Li, Y., Yao, Y., Luo, X., He, X., Yin, W., 2018. Development of construction workers job stress scale to study and the relationship between job stress and safety behavior: an empirical study in Beijing. Int. J. Environ. Res. Public Health 15 (11), 2409. https://doi.org/10.3390/ijerph15112409.
Xanthopoulou, D., Bakker, A.B., Demerouti, E., Schaufeli, W.B., 2009. Reciprocal relationships between job resources, personal resources, and work engagement. J. Vocat. Behav. 74 (3), 235–244. https://doi.org/10.1016/j.jvb.2008.11.003.
Yu, M., Li, J., 2020. Psychosocial safety climate and unsafe behavior among miners in China: the mediating role of work stress and job burnout. Psychol. Health Med. 25 (7), 793–801. https://doi.org/10.1080/13548506.2019.1662068.

Yuan, Z., Li, Y., Tetrick, L.E., 2015. Job hindrances, job resources, and safety performance: the mediating role of job engagement. Appl. Ergon. 51, 163–171. https://doi.org/10.1016/j.apergo.2015.04.021.

Zagaria, A., Ando, A., Zennaro, A., 2020. Psychology: a giant with feet of clay. Integr. Psychol. Behav. Sci. 54 (3), 521–562. https://doi.org/10.1007/s12124-020-09524-5.

Aase, K., Nybo, G., 2005. Organisational knowledge in high-risk industries: supplementing model-based learning approaches. Int. J. Learn. Intellect. Capital 2 (1), 49–65.