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Factors Influencing Unsafe Behaviors and Accidents on Construction Sites: A Review

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Objective. *Construction is a hazardous occupation due to the unique nature of activities involved and the repetitiveness of several field behaviors. The aim of this methodological and theoretical review is to explore the empirical factors influencing unsafe behaviors and accidents on construction sites.* ***Methods.*** *In this work, results and findings from 56 related previous studies were investigated. These studies were categorized based on their design, type, methods of data collection, analytical methods, variables, and key findings. A qualitative content analysis procedure was used to extract variables, themes, and factors. In addition, all studies were reviewed to determine the quality rating and to evaluate the strength of provided evidence.* ***Results.*** *The content analysis identified 8 main categories: (a) society, (b) organization, (c) project management, (d) supervision, (e) contractor, (f) site condition, (g) work group, and (h) individual characteristics. The review highlighted the importance of more distal factors, e.g., society and organization, and project management, that may contribute to reducing the likelihood of unsafe behaviors and accidents through the promotion of site condition and individual features (as proximal factors).* ***Conclusion.*** *Further research is necessary to provide a better understanding of the links between unsafe behavior theories and empirical findings, challenge theoretical assumptions, develop new applied theories, and make stronger recommendations.*

unsafe behavior   accident   construction   content analysis   review

1. INTRODUCTION

With rapid economic development and industrialization, the construction industry continues to rank among the most hazardous industries in the world. Within the construction industry, the risk of a fatality is 5 times higher than in manufacturing, whilst the risk of a major injury is 2.5 times higher [1].

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Occupational injuries and fatalities within the construction industry have also been associated with considerable financial costs. It has been estimated that such injuries cost over 10 billion USD per year [2].

Occupational safety in general, and construction safety in particular, is a complex phenomenon [1]. Therefore, construction safety has always been a significant concern for both practitioners and researchers [3]. Accident causality and, therefore, risk reduction on construction sites is complex and multifaceted [4] and accident prevention begins with having a clear understanding of those factors that play key roles in their causation [5]. Several attempts have been made to investigate factors influencing safety performance on construction sites. Safety on construction sites is impacted by many factors. Although much research has been carried out on this area to introduce different causes and contributory factors, Teo, Ling, and Chong point out that previous studies did not provide a holistic framework that may help project managers handle the various policy, process, personnel, and incentive aspects that may affect construction safety [6]. This study, therefore, aims to fill this gap by extracting a framework to help identify effective interventions on construction sites. At present, there is little research on the key causes and contributory factors of unsafe behaviors and accidents on construction sites. The aim of this study is to (a) explore the empirical factors influencing unsafe behaviors and accidents on construction sites, (b) perform content analysis of previous studies to categorize such influencing factors, and (c) review the quality of previous studies to evaluate the strength of evidence provided in each study.

2. METHODOLOGY

2.1. Literature Search and Inclusion Criteria

In this work, the literature review included studies that investigated unsafe behaviors and accidents in the construction industry. First, we searched keywords, titles, and abstracts using EndNote version X4[1] in major commercial bibliographic databases of work published between January 1999 and May 2012. These databases included PubMed[2] and Web of Science[3]. Next, an additional round of database searching was completed. The new databases included CINAHL[4], Health and Safety Science Abstracts[5], ProQuest[6], PsycINFO[7], PsycARTICLES[8], Social Sciences Full Text[9], ASCE library[10], Construction and Building Abstracts (CBA)[11], International Civil Engineering Abstracts[12], Taylor & Francis Online[13], Wiley Online Library[14], and Annual Reviews[15]. To identify relevant previous studies, the research keywords were selected to be ("unsafe behavior" OR "unsafe behaviour") AND (accident OR incident) AND (construction OR building). In addition, we manually searched reference lists of all articles. After removing the duplicates using EndNote software, the total numbers of studies identified were 341.

The titles and abstracts were then reviewed by each author and those identified as relevant to the review were selected to be retrieved and reviewed in full. Studies were selected based on the following inclusion criteria: (a) the study was empirical with a substantive focus on identifying factors that influence the unsafe behaviors and accidents, (b) the participants were construction employees and unsafe behaviors and accidents were work-related, (c) the study was published between January 1999

[1] http://endnote.com/
[2] http://www.ncbi.nlm.nih.gov/pubmed
[3] http://thomsonreuters.com/web-of-science/
[4] http://www.ebscohost.com/nursing/products/cinahl-databases/cinahl-complete
[5] http://www.csa.com/factsheets/health-safety-set-c.php
[6] http://www.proquest.com
[7] http://www.apa.org/pubs/databases/psycinfo/
[8] http://www.apa.org/pubs/databases/psycarticles/
[9] http://www.ebscohost.com/academic/social-sciences-full-text
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[14] http://onlinelibrary.wiley.com/
[15] http://www.annualreviews.org/

and May 2012, (d) the study was available online, (e) the study was published in a refereed journal, and (f) the study was written in English. In total, 56 studies were included in the final review to determine variables that influence unsafe behaviors and accidents on construction sites (Figure 1).

2.2. Data Extraction and Analysis

We categorized all selected studies based on study design, study type, methods of data collection, analytical methods, variables, and key findings. We populated a structured data extraction form using data retrieved from each study. Then, each study was reviewed and evaluated with regard to the trustworthiness of the extracted data. We used a qualitative content analysis procedure provided by the Weft QDA software [7]. Content analysis is defined as a systematic, replicable technique for compressing many words of text into fewer content categories based on explicit rules of coding [8]. Variables that were tested as cause or contributory factor of unsafe behaviors and accidents were analyzed based on whether they had a positive, negative, or evidence-based association with unsafe behaviors and accidents. These variables were further condensed according to some common themes, which were later grouped under eight categories (or factors).

Additionally, studies were reviewed to determine the quality rating based on the analysis approach, i.e., qualitative, quantitative, and mixed analysis [9]. General criteria used for quality rating of the qualitative and quantitative methodologies were a clear research question and aims; an appropriate empirical research approach; a clear description of appropriate sampling, data collection, and data analysis procedures; a clear description of the study context; research findings; value of the research; ethical issues; and reflexivity. We used three different checklists for rating selected studies based on whether they had a qualitative, qualitative, or mixed methodology [10, 11, 12, 13, 14]. We applied cumulative ratings of *good* (up to 50% score), *fair* (50%–75% score), or *poor* (75%–100% score) to each individual study [10]. Quality rating appraisal helped us evaluate the strength of evidence provided by each study. Furthermore, we evaluated the direction and

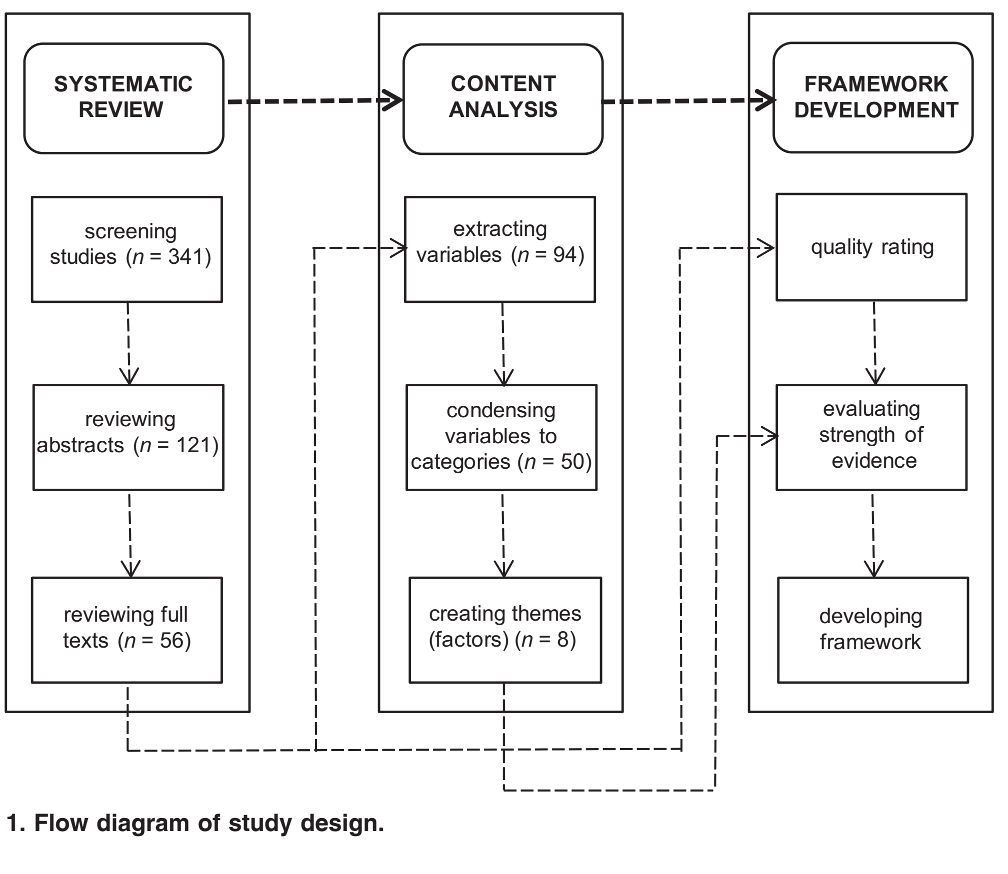

Figure 1. Flow diagram of study design.

significance of any association found among the contributory factors and unsafe behaviors and accidents.

Therefore, we evaluated strength of evidence as follows:

- high evidence: three or more *good* studies reported a certain influence;
- moderate evidence: two *good* studies and three or more *fair* studies reported a certain influence;
- low evidence: one *good* study, one or two *fair* studies, and three or more *poor* studies reported a certain influence.

3. RESULTS AND DISCUSSION

Appendix A on p. 125 presents a sample detailed description of the full data extracted from 56 studies that met the inclusion criteria. The completed tables can be obtained from the corresponding author upon request. In the reviewed studies, 94 variables were tested to determine their association with unsafe behaviors and accidents on construction sites.

These variables were grouped into 50 themes and eight contributory factors, namely, society, organization, project management, supervision, contractor, site condition, work group, and individual characteristics. Figure 2 summarizes the groupings of the themes into contributory factors in the form of a conceptual model. Table 1 summarizes associations between the contributory factors and unsafe behaviors and accidents as well as the directions of these associations. Furthermore, Figure 3 shows the strength of evidence of factors influencing unsafe behaviors and accidents.

3.1. Contributory Factors

From the literature and content analysis, the key factors that may contribute to accidents and unsafe behaviors on construction sites were extracted. These areas are briefly reviewed in subsections 3.1.1–8.

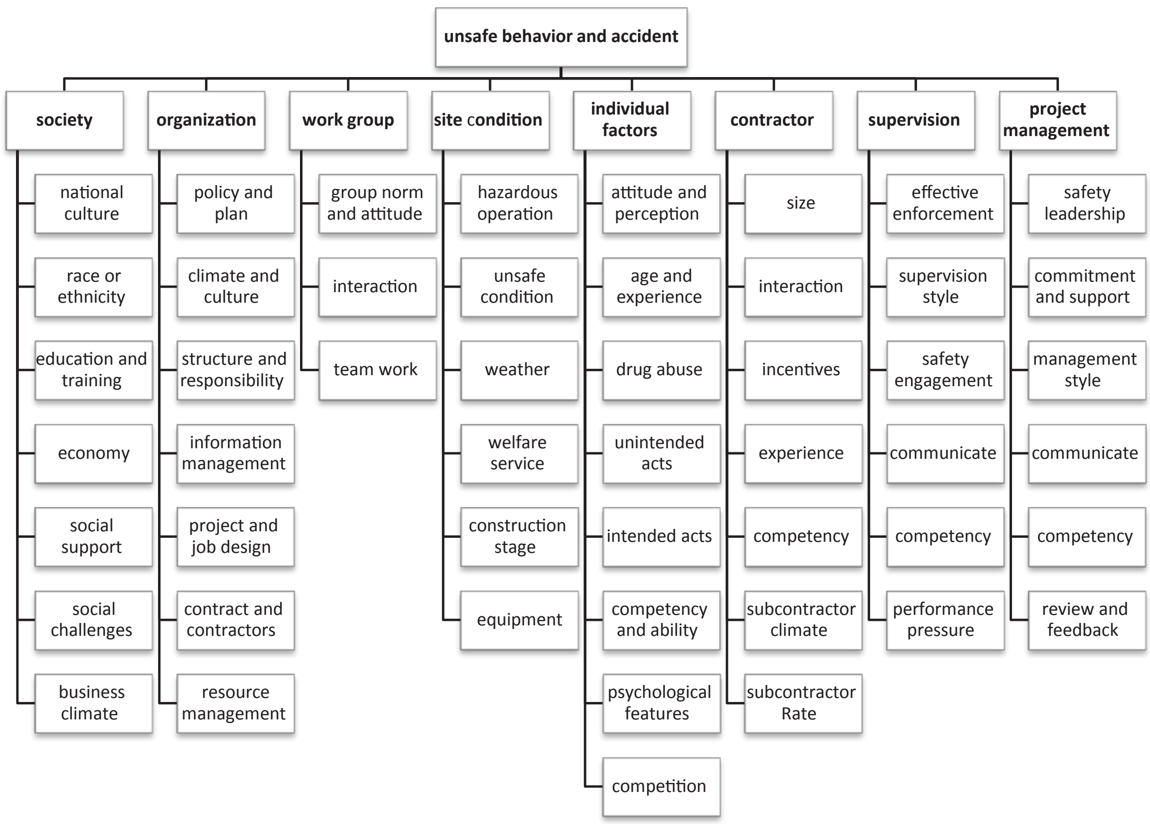

Figure 2. New conceptual framework for factors influencing unsafe behaviors and accidents on construction sites.

TABLE 1. Association Between Contributory Factors and Unsafe Behaviors and Accidents

Contributory Factors	Studies (Citation No.)	Associations
Individual characteristics		
age and experience	[17], [20], [36], [46], [47], [48]	0/–/&/&/&/–
drug abuse	[22], [49]	&/+
unintended acts	[27], [50], [51]	0/0/&
intended acts	[6], [50], [51], [52], [53], [54], [55]	&/0/0/0/0/+/0
competency and ability	[18], [26], [38], [50], [51]	0/0/–/0/&
attitude and motivation	[6], [18], [20], [26], [28], [30], [38], [48], [50], [54], [55], [56], [57]	0/0/–/0/0/–/–/–/0/–/0/–/–
psychological distress	[17], [24], [30], [32], [49], [57]	0/+/+/+/+/+
Site condition		
hazardous operation	[15], [17], [19], [50], [55]	0/0/+/0/0
unsafe condition	[2], [15], [24], [38], [50], [51], [53], [55], [58], [59], [60]	0/0/+/0/+/&/0/0/0/0/0
weather	[46], [61]	&/0
welfare service	[17]	0
construction stage	[62]	0
equipment	[2], [18], [51], [52], [59]	0/0/&/0/0
Work group		
group norm and attitude	[18]	0
interaction	[25]	0
team work	[18], [28], [59]	0/0/0
Contractor		
size	[19], [20], [22], [47], [53]	–/–/&/&/0
interaction	[25], [53]	0/0
incentives	[17], [22]	0/0
competency	[53]	0
subcontractor climate	[22], [33]	&/0
subcontractor rate	[15], [27], [61], [63]	0/0/0/+
Supervision		
effective enforcement	[17], [18], [19], [55], [63]	0/0/–/0/–
supervision style	[18], [28], [34], [59],	0/0/–/0
safety engagement	[17], [18], [64]	0/0/0
communication	[17], [18], [65]	0/0/–
competency	[18]	0
performance pressure	[17], [25], [27], [28]	0/0/0/0
Project management		
safety leadership	[66]	0
commitment and support	[2], [6], [18], [25], [28], [29], [30], [31], [37], [67], [68]	–/0/0/0/0/0/–/–/–/–/–
management style	[2], [3], [18], [27], [29], [30], [36], [58], [66], [68]	0/–/0/0/0/–/0/0/–
communication	[3], [18]	–/0
competency	[18], [53], [54], [69]	0/0/–/0
review and feedback	[18], [29], [30]	0/–/–

TABLE 1. (*continued*)

Contributory Factors	Studies (Citation No.)	Associations
Organization		
policy and plan	[1], [2], [6], [15], [17], [18], [19], [25], [27], [28], [29], [31], [37], [62], [70]	–/–/–/0/0/0/0/0/0/0/0/–/0/0/0
climate and culture	[20], [33], [34], [35], [36], [56], [61], [70]	–/–/–/–/&/–/0/0
structure and responsibility	[2], [18], [30], [33]	0/0/–/–
information management	[2], [17], [18], [20], [25], [26], [27], [28], [29], [30], [33], [37], [52], [55], [56], [61], [68], [69], [70], [71]	0/0/0/–/0/0/0/0/0/–/–/–/0/0/–/0/–/0/0/0
project and job design	[4], [15], [22], [27], [33], [61], [62], [64], [72]	0/0/&/0–/0/0/0/0
contract management	[15], [27], [47], [62], [61]	0/0/&/0/0
resource management	[18], [55], [69], [71]	0/0/0/0
Society		
societal culture	[26], [38]	0/–
race or ethnicity	[19]	&
education and knowledge	[6], [17], [49], [52], [73]	0/0/–/0/0
economy	[17], [29]	0/0
social support	[33], [38]	0/–
social challenges	[15], [49], [61], [73]	0/0/0/0
business climate	[61], [73]	0/0

Notes. 0 = empirical based association found, but the study did not report a statistical association; & = a statistical association found, but the study did not report a certain influence; + = significant positive association found; – = significant negative association found.

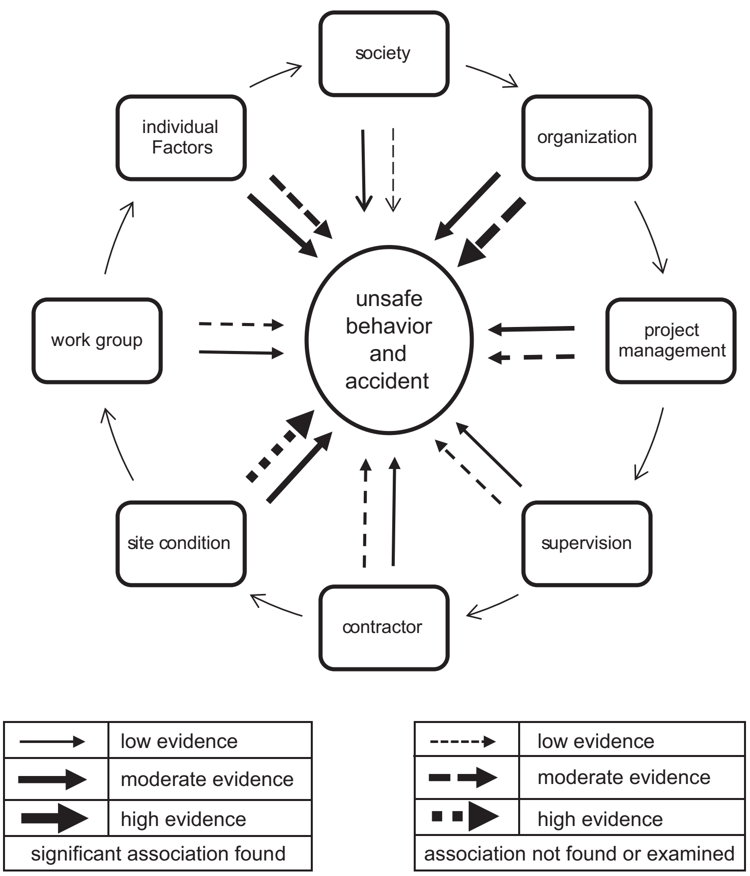

Figure 3. Strength of evidence of factors influencing unsafe behaviors and accidents on construction sites.

3.1.1. Individual characteristics

Quality rating of previous studies showed that one of the most important factors influencing unsafe behaviors and accidents was individual characteristics (Figure 3). Different studies introduced different variables. Seven themes were extracted from content analysis, i.e., attitude and motivation, age and experience, drug abuse, unintended acts, intended acts, competency and ability, and psychological distress. Among all the investigated individual characteristics, safety attitude and motivation, and age and experience showed moderate evidence of positive association with unsafe behaviors and accidents. There are many studies that identified inappropriate action (e.g., unsafe acts, improper use or no use at all of the provided personal protection equipment [PPE], and taking shortcuts) as the immediate cause of construction accidents. For example, Suraji, Duff, and Peckitt identified inappropriate operative action as a proximal factor rather than a distal factor [15]. The proximal factors, e.g., shortcoming in workmanship, may be the outcome of a violation rather than a cause [16]. Therefore, there is a clear relationship between individual characteristics and other distal factors influencing unsafe behavior and accident on construction sites.

3.1.2. Site condition

Most construction activities take place in rapidly changing environments and under evolving site conditions. Therefore, as Figure 2 suggests, this category covers an extended range of themes including hazardous operation, unsafe condition, equipment, weather, welfare services, and construction stage. Themes such as unsafe condition, hazardous operation, unsafe equipment, and bad weather had moderate evidence of positive association with unsafe behaviors and accidents. Construction-related tasks are often risky due to factors such as outdoor operations, work at heights, complicated site plants, and equipment operations coupled with workers' attitudes and behaviors towards safety [17]. Most studies in this field have focused only on accident records as data source and, as such, are likely subject to underestimated error. Another problem is that the site condition like the individual features, can be categorized as a proximal factor rather than a distal one [15]. Therefore, one question that needs to be addressed is what factors are behind the unsafe conditions of a construction site.

3.1.3. Work group

Three themes, i.e., group norm and attitude, group interaction, and team work, were extracted. The literature indicated that these factors had low evidence of an uncertain association with unsafe behaviors and accidents. Group norms are the accepted attitudes about various things amongst a group of people. If positive attitudes towards safety can be built and embedded within a group, safety can then be managed successfully. Therefore, this is a basis of good safety culture [18]. However, much of previous research has been descriptive in nature. Future study on this topic is, therefore, recommended.

3.1.4. Contractor

Six themes, i.e., contractor size, interaction, incentives, competency, subcontractor climate, and subcontractor rate, had moderate evidence of association with unsafe behaviors and accidents (Figure 3). Among all such themes, contractor size had significant negative association with accidents. According to Sa, Seo, and Choi, fall accidents have a negative association with company size [19]. In addition, Kaskutas, Dale, Lipscomb, et al. found that unsafe behaviors were negatively associated with employer size [20].

On the other hand, large companies use pools of subcontractors and there is a tendency for contract tenders to be based on price, with little margin for occupational health and safety investments [21]. Normally, subcontractors are responsible for their own work volume. Nevertheless, when a safety lapse occurs in their work, the accident is immediately charged to the primary contractor [17]. The focus of many studies involving the construction industry has been on general contractors [22]. Therefore, the role of subcontractors on unsafe behaviors and accidents on construction sites should be better understood.

3.1.5. Supervision

Six themes, i.e., effective enforcement, supervision style, safety engagement, communication, competency, and performance pressure, were extracted in this category. It was revealed that effective enforcement, worker–supervision communication, and good supervision style had moderate evidence of negative association with unsafe behaviors and accidents. Lee and Halpin depicted that supervision was related to safety performance [23], while Meliá and Becerril demonstrated that factors related to the supervisors, e.g., lack of feedback, poor communication, poor relations with superiors, and inadequate managerial support, were cited by workers as important causes of their occupational stress [24]. Work pressure [25, 26], "my boss is in the habit of saying "hurry up" [17], and "hurry to finish the work" [27] may mostly concern supervision style rather than contribute to an increase in unsafe behaviors and accidents. Furthermore, previous studies had general agreement about a positive influence of the effective enforcement on safety performance on construction sites [18, 27, 28].

3.1.6. Project management

Six themes, i.e., safety leadership, management commitment and support, management style, safety communication, competency, and review and feedback, had high evidence of negative association with unsafe behaviors and accidents. Several studies revealed that management commitment played a significant role in safety performance and accident reduction [2, 6, 18, 29, 30, 31]. Another theme that was considered in previous studies was safety communication. This includes, e.g., toolbox talks with managers [17], worker–manager communication about hazardous situations [30], and management's discussion of safety [1]. One criticism of much of the literature on the relationship between project management factors and unsafe behavior is that the mechanism of their relationship is not clearly understood.

3.1.7. Organization

There is a large volume of previous studies describing the role of organization on safety performance on construction sites. As shown in Figure 3, the most important factor influencing unsafe behaviors and accidents is organization. Seven dominant themes, i.e., policy and plan, safety climate and culture, structure and responsibility, information management, project and job design, contract management, and resource management, had high evidence of negative association with unsafe behaviors and accidents.

Over the past few years, researchers and practitioners have gradually recognized the importance of organizational factors, e.g., safety climate [3]. There has been an increasing amount of literature on safety climate in construction sites [25, 32, 33, 34, 35, 36].

Recent theoretical and empirical studies indicated that safety climate was a multidimensional construct that was often used interchangeably with the term safety culture [33]. Safety culture must be viewed not only as an alternative to safety climate but also as a provider of safety climate. Researchers investigating safety culture through safety climate measure have a propensity to focus solely on the way people think (their perceptions), and do not represent various aspects of safety culture [37].

Although the multidimensional nature of safety climate is no longer being debated, the exact nature of the dimensions is still being studied [33]. With a few exceptions, previous research lacks a clear distinction between safety climate and individual attitudes [35]. Not surprisingly, research based on very different safety climate instruments, without a clear identification of the issues that should be included and the agents responsible for such issues, has yielded different sets of dimensions whose results only partially overlap [34]. Glendon and Litherland claimed that factors that influence safety climate within one industry might not be valid in another [25]. The construction industry falls under the organic type of organizations, rather than mechanistic type, where the nature of the work, working environment, and job site conditions change rapidly. Mechanistic organizations allow for the exclusion of decision-making roles, and rules and procedures to be followed, while organic types rely on decision-making roles, the use of the workforce, and training facilities for workers to carry out nonstandardized operations [17]. Nevertheless, previous studies do not take into account the organic nature of construction sites nor do they define clear diminutions of safety climate and culture.

3.1.8. Society

Seven themes, i.e., societal culture, race or ethnicity, education and knowledge, economy, social support, social challenges, and business climate, were extracted. Several studies highlighted the role of social factors on unsafe behaviors and accidents. Examples include national culture [34, 38], local worker and cultural and language problems [17], social support [33], race or ethnicity [19]. Ng, Cheng, and Skitmore maintained that in a market-driven society, it is common for construction stakeholders especially those at the lower end of the supply chain to concentrate exclusively on completing projects to the required quality standard with the minimum time and cost. Therefore, safety is regarded as a secondary concern [29]. Goldenhar, Williams, and Swanson identified insufficient social support as an occupational stress [33]. Suraji et al. mentioned two reasons for the influence of society on the construction safety. First, workers themselves can be directly influenced by external factors, e.g., pressures from the social, economic, or political climate or environmental conditions. As a result, these factors can distract them from their work, potentially leading to accidents. Second, the client is under a number of distal factors, e.g., economic, social, and political pressures, during the conceptual development of a project. The client response will provide many of the constraints, within which the project management, design participants, and subcontractors have to operate unsafely. This cause-and-effect process has the potential to increase workers' constraints directly or indirectly through inappropriate construction planning or inappropriate construction control procedures, leading to inappropriate site conditions, inappropriate worker actions, or inappropriate construction operations [15].

3.2. Overall Discussion

Existing empirical attempts to study safety preconditions and their relationship to organizational outcomes have remained fragmented and underspecified in theoretical terms [39]. The present study has generated a detailed qualitative picture of the nature and range of factors that influence unsafe behaviors and accidents on construction sites.

In accordance with Zohar's opinion [40], we found that many previous studies in this field have mainly focused on methodological rather than theoretical or conceptual issues. As a result, this review identified many studies that were conducted to explore the factors influencing construction safety, through covering over 94 different variables or conceptual subthemes. During our preliminary research, we identified a major conceptual ambiguity and, therefore, the need for greater direction at theoretical issues [40, 41]. Therefore, this review highlighted a number of conceptual issues associated with the factors influencing safety performance in the construction industry, not only to reduce conceptual ambiguity but also to provide better understanding of the links between theory and empirical findings, leading to the emergence of an integrated conceptual model.

In addition, this study used meta-analysis to examine the relationships among contributory factors and unsafe behaviors and accidents. Results indicated that the organization had high evidence of association with unsafe behaviors and accidents, closely followed by project management, site condition, and individual characteristics. The conceptual model in Figure 3 was used to identify the distal factors including social and organizational preconditions that reduce the likelihood of unsafe behaviors and accidents through the promotion of working condition and individual characteristics (as proximal factors). The organizational preconditions behind the major system failures are seen as increasingly important for risk management [39]. Among these preconditions, safety culture and climate represent new approaches for conceptualizing processes of risk handling and management in social and organizational contexts [42, 43].

The development of a conceptual model of safety issues offers a number of advantages. Theoretically, the integrated model provides a contextual framework to identify the structures of safety scales including the contributory factors as listed in this paper. Furthermore, this contextual framework offers a common language that reduces the likelihood of ambiguity in this field of research. In addition, the conceptual model can be used to integrate both proximal and distal factors of unsafe behaviors and accidents and to develop the proposed structural model in future multivariate analyses. Zohar concluded that more work was required to augment the safety climate theory and the time had come to move to the next phase by testing its relationships with antecedents, moderators, and mediators as well as relationships with other established constructs [40].

Practically, this integrated conceptual model can be used to achieve a "safe organization" level [44] in the construction industry. For example, this conceptual model can be used as a causation framework in applied accident investigations conducted by practitioners. Most existing accident investigation techniques stop at a premature level and fail to identify the root causes of accidents. Furthermore, this makes it possible to develop a preventative safety approach in which the success factors in construction organizations are used to identify critical failures before an unsafe behavior or accident has occurred.

3.3. Limitations and Future Directions

Accident prevention begins with having a clear understanding of factors that play key roles in their causation [45]. Despite extensive research in this area, the key factors that may contribute to unsafe behaviors and accidents should be better and deeper understood. However, no systematic attempt has been made to quantify the association among key contributory factors, and unsafe behaviors and accidents through the use of multivariate statistical analysis, e.g., structural equation model. Further studies with more focus on unsafe behavior and accident causation are, therefore, recommended.

This review also showed the lack of longitudinal and mixed method research with high quality rating on this topic. Although a qualitative approach has been less common than other methods in safety research, researchers have found that qualitative and mixed method research is useful for understanding workers' perceptions of safety and risk. For example, Gittleman, Gardner, Haile, et al. listed at least two benefits for conducting mixed method research on construction sites. First, workers often identified specific problems and provided specific ideas for solutions in the qualitative step. Second, the findings from the qualitative step can be converged with the quantitative step of the survey in some of the safety issues [2]. However, the integration of qualitative and quantitative approaches continues to be one of much debate and there is a need for a rigorous framework for designing and interpreting mixed method research. Using triangulation as a methodological metaphor can facilitate the integration of qualitative and quantitative findings, and help researchers clarify their theoretical propositions and the basis of their results. This can offer a better understanding of the links between theory and empirical findings, challenge theoretical assumptions, and develop new theory [9].

4. CONCLUSION

In conclusion, this review confirmed that the causes of unsafe behaviors and accidents on construction sites appeared to be multifactorial, and were generally related to (a) society, (b) organization, (c) project management, (d) supervision, (e) contractor, (f) site condition, (g) work group, and (h) individual characteristics. Results of the review supported the importance of the distal factors, e.g., the society, organization, and project management, which may contribute to reducing the likelihood of unsafe behaviors and accidents beyond the proximal factors, e.g., site condition and individual characteristics. The new integrated conceptual model can be used by researchers and practitioners to better understand the factors influencing safety performance. However, further research should be conducted to determine which factors consistently cause unsafe behaviors and accidents and to define the influence mechanism of distal factors on proximal factors.

This review also highlighted the lack of qualitative and mixed method research with high quality rating on this topic. Further longitudinal research and mixed method research will be necessary to obtain additional information and gain a better understanding of the workers' experiences, and to make stronger recommendations for more effective interventions.

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APPENDIX A. A sample table of characteristics of included studies

Reference (Country)	Study Design	Study Type	Method of Data Collection	Analytical Method	Variables and Key Finding	Quality Rating
[3] (USA)	cross-sectional	quantitative	questionnaire study with union construction workers employed by 15 contractors ($n = 235$)	intercorrelation analysis, random coefficients model	Results revealed significant main effects for safety communication and error management climate on safety behaviors.	good
[1] (UK)	single site case and cross-sectional	sequential mixed method	operative interviews ($n = 2$), site manager interviews ($n = 2$), safety officer interview ($n = 1$), operative questionnaire ($n = 120$)	Pearson's correlation coefficient, factor analysis	Most influential factor driving safety performance is "the organization policy toward safety".	fair
[26] (Sweden)	single case	qualitative	interview with safety worker representatives ($n = 5$) and first-line managers ($n = 19$)	phenomenological methodology	4 main categories of work safety preconditions: (a) project characteristics; (b) organization and structures; (c) collective values, norms; (d) individual features competence and attitudes	good