

Cognitive Biases in Occupational Safety and Health: A Systematic Review of Prevalence and the Evidence for Effective Debiasing Strategies

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Abstract

This systematic literature review synthesizes empirical and theoretical research on cognitive biases and debiasing strategies within occupational safety and health (OSH). Following PRISMA guidelines, the authors analyzed peer-reviewed literature, identifying only 13 relevant studies from an initial pool of 705. The findings confirm the influence of cognitive biases across critical OSH domains: accident causation (e.g., attribution errors), safety decision-making (e.g., overconfidence, optimism bias), hazard perception (e.g., confirmation bias), and safety management systems (e.g., hindsight bias, reductionism). These biases systematically distort judgment and risk perception, often prioritizing individual blame over systemic factors. Crucially, the review reveals a significant research gap: while the existence and impact of biases are well-documented, empirically validated and OSH-specific debiasing strategies remain notably underdeveloped and understudied. Analysis of existing interventions indicates that standardized checklists are often ineffective or counterproductive. In contrast, strategies emphasizing deliberate system design, such as pre-mortem analysis, scenario-based learning, structured training incorporating accountability (e.g., pause and reflect slowdowns), and customized programs addressing operational realities, demonstrate greater potential. The findings underscore the urgent need for further empirical research and implementation of targeted debiasing techniques to enhance decision-making and safety outcomes in OSH practice.

Keywords

Cognitive Biases, Debiasing, Occupational Safety and Health, Workplace Safety, And Safety Behavior

1. Introduction

Cognitive biases are defined as deviations from what is considered “rational” judgement, leading individuals to shape their understanding based on their unique interpretation of reality. These mental shortcuts enable us to process information and make decision-making quick. However, these shortcuts are not without trade-offs. Everyone is susceptible to these inherent patterns of thought and in the context of occupational safety and health (OSH), these shortcuts can shape how decision-making occurs in incident investigation, training environments, and professional judgement [1] [2].

Research efforts in OSH with regard to cognitive biases have largely centered on identifying how and where these mental patterns occur. For example, Van Wassenhove *et al.* [2] found 25 factors that shape and influence the role of safety professionals in three different areas: institutional, relational, and individual. Thallapureddy *et al.* [3] found that in the process of information collection for incident investigations, biases most often emerged in the interview process. Illustrating a potential cognitive bias, Maclean and Dror [4] found that workplace safety inspectors denied the impact of contextual factors on hazard judgements, despite empirical data contradicting this. Additionally, they found that if inspectors believed a company had an unsafe history, a greater number of findings were identified during that inspection [2] [5] [6].

Reiman and Rollenhagen [7] describe how biases emerge in safety management systems and the potential consequences. They found that biases were prevalent in commonly used safety models such as accident models that presume humans as a liability. They also found anchored beliefs in linear causality and a one size fits all approach, neglecting any context around causality.

Cognitive biases in OSH contexts have received considerable scholarly attention, however, research concerning the development, application, and efficacy of debiasing strategies in this specific domain remains notably limited. These systematic biases fundamentally shape OSH decision-making processes at all levels, frequently inducing deviations of safety judgment even when confronted with empirical evidence [8]. Consequently, mitigating cognitive biases holds significant potential for enhancing decision quality among safety professionals; however, empirically validated debiasing techniques and assessment of their effectiveness are often neglected or inadequately adapted to the OSH domain. To bridge this gap, the authors conducted a systematic review of peer-reviewed literature, synthesizing both foundational theoretical frameworks and empirical findings on cognitive biases and their mitigation strategies specifically relevant to OSH.

2. Method

2.1. Design

A systematic literature review (SLR) was conducted to examine cognitive biases and their debiasing strategies within the context of OSH. The recommended structure for this review followed the structure proposed by Booth *et al.* [9]: (1)

this consists of defining the scope and purpose, in this case, specifically what debiasing strategies have been implemented in the OSH context. (2) Selecting the databases; (3) define inclusion and exclusion criteria; (4) performing the search to find literature; (5) Screen literature based on criteria; (6) data extraction; (7) final review and synthesis of results.

2.2. Literature Search Strategy

The authors conducted an extensive search in the following electronic databases: *EBSCOhost* Databases, Google Scholar, and *Science Direct*. These databases were selected due to the availability of peer-reviewed OSH-relevant indexes available. For instance, EBSCOHost contains the Academic Search Ultimate database, which indexes the *Journal of Occupational & Environmental Medicine*.

The search strategy for these databases was the following: (“bias” OR “biases” OR “cognitive bias” OR “debias” or “Debiasing”) AND (“workplace safety” OR “occupational safety” OR “safety behavior” OR “Health and Safety”). These combine two key concept blocks using Boolean AND. Concept A is biased and debiasing terminology, while concept B is in occupational safety and health contexts. The date range for the search strategy was January 1, 2010 to July 1, 2025.

2.3. Inclusion Criteria

The SLR identified literature on cognitive biases and debiasing in occupational safety and health (OSH) settings. For inclusion in this review, identified studies needed to be peer-reviewed, journal articles, published in English, and available in full text. These criteria supported the feasibility of analysis and access to methodologically rigorous evidence.

2.4. Exclusion Criteria

Studies identified by the SLR were excluded based on topical relevance. Specifically, articles were excluded if they were not related to the OSH industry and did not examine or list specific debiasing strategies. This ensured the review maintained its focus on debiasing interventions within OSH. For instance, studies on cognitive biases in healthcare management (without OSH context) or purely theoretical bias discussions without practical debiasing strategies were excluded.

2.5. Data Search

To systematically investigate cognitive biases and debiasing strategies specific to the OSH industry, the keywords for this literature review were divided into two thematic groups. The first group was focused on cognitive biases and debiasing strategies. The second group encompassed the occupational safety and health domain. This approach bridged theoretical mitigation methods with industry-specific applications.

In order to thoroughly review the literature beyond the scope, title, and abstracts, a full-text search was performed to enable the authors to find relevant in-

formation with regard to debiasing techniques. **Figure 1** presents the data retrieval process the authors utilized which adheres to the recommended preferred reporting items for systematic reviews and meta-analyses (PRISMA) [9].

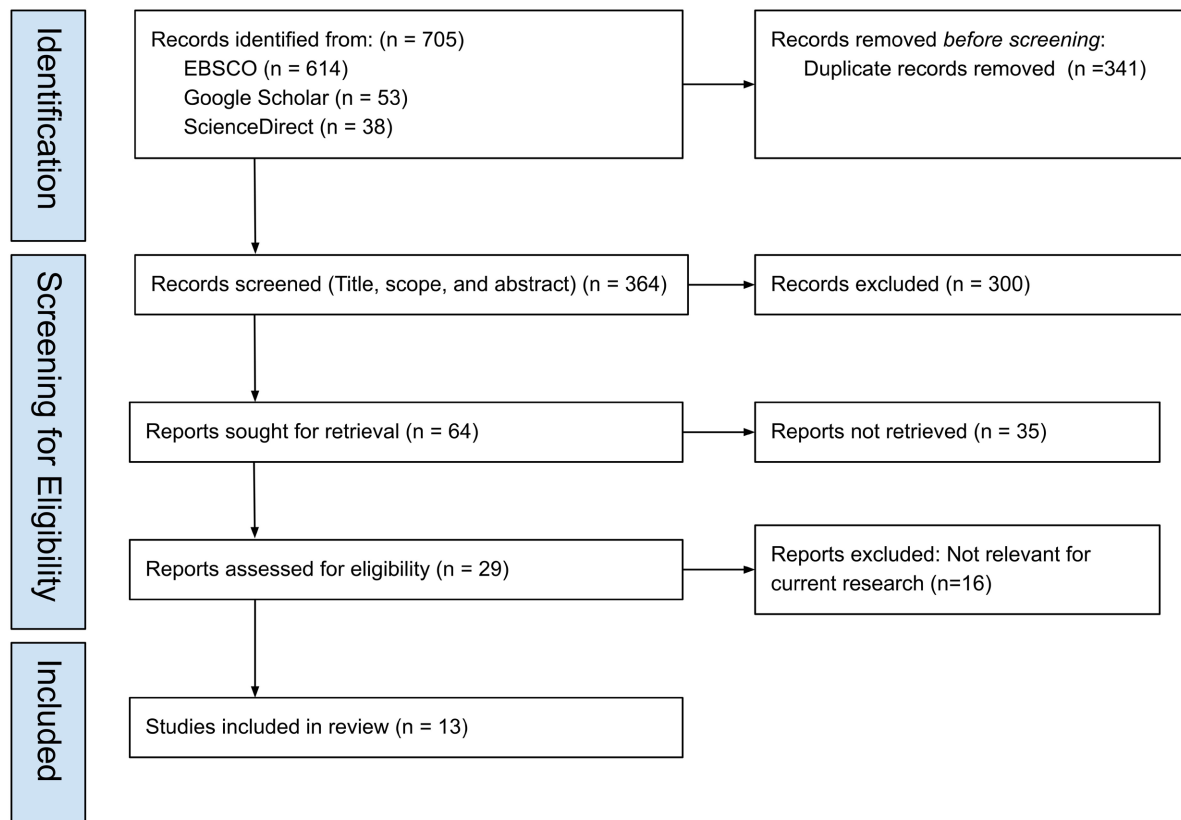


Figure 1. PRISMA flowchart for systematic literature review. *Note.* This figure (e.g., a PRISMA flow diagram) outlines the study selection process, displaying the total articles identified, the number screened for eligibility, and the final number included in the systematic review.

2.6. Data Extraction and Data Coding

To ensure a rigorous and transparent synthesis, the coding of cognitive biases and debiasing strategies was conducted through a systematic, multi-phase process utilizing thematic analysis [10].

First, a preliminary coding framework was established based on the research objective and key concepts from the literature. The full text of each included study was then independently reviewed by one author, who extracted all relevant data and applied codes to text segments pertaining to specific bias such as fundamental attribution error and any mention of debiasing strategies as well as their effectiveness. These were categorized according to established definitions of cognitive biases. To ensure consistency and to mitigate individual biases, a second author performed independent validation of all extractions and coding. Any discrepancies identified were resolved through iterative consensus discussions. This process of independent coding and validation ensured the final thematic analysis was both reliable and reflective of the evidence presented across the studies (**Table 1**).

Table 1. Example of coding scheme.

Title	OSH Domain	Cognitive Bias (Code)	Debiasing Strategy (Code)
Using Scenarios to Align Safety Leadership.	Workplace safety decision-making	Recency Bias, overconfidence,	Scenario Based Learning (SBL)
Measuring base-rate bias error in workplace safety investigators	Workplace Safety Investigation	Confirmation Bias	CA Chart

Note. This table illustrates the coding scheme utilized by the authors to review the included studies.

2.7. Synthesis Procedure

A narrative thematic synthesis was conducted due to the methodological heterogeneity of the studies that met the inclusion criteria. To ensure accuracy and consistency of the data extraction and coding, the following sequential process was employed.

1) Primary coding: One author performed the initial data extraction and coding of the full text of all 13 included studies. This involved identifying and categorizing mentions of cognitive biases and debiasing strategies, as well as documenting the study design, sample, setting, and key findings.

2) Validation and verification: To ensure analytical rigor, the second author independently assessed all data extractions, preliminary codes, and to determine if inclusion was appropriate.

3) Consensus building: Any discrepancies, disagreements, or suggestions for additional codes were resolved through discussion and consensus. Due to the small final sample size ($n = 13$), this process of independent validation and consensus-based reconciliation served to ensure the reliability of the coding framework.

2.8. Synthesis of the Results

The literature search strategy identified 705 articles through the database search. The initial identification stage consisted of duplicate removal ($n = 341$), resulting in 364 unique articles for further review. In the screening stage, these 364 articles were reviewed based on the titles, scopes, and abstracts against the predetermined inclusion criteria. This stage led to the exclusion of 300 articles, reducing the total amount to 64. The following stage was a more in-depth review, searching for specific keywords to determine if they fit the inclusion criteria. This resulted in the exclusion of 35 additional articles. Finally, 16 more articles were removed because they fell outside the scope of the current OSH industry focus, resulting in a total of 13 articles for review.

The inherent heterogeneity of the final data set, resulting from its diversity of occupational safety and health domains and its exploration of varied aspects of cognitive biases and debiasing strategies, necessitates the use of a narrative syn-

this approach to effectively summarize the findings. Consequently, a meta-analysis would not be effective given the variability of the data. The results for the debiasing strategies are summarized below in table form (**Table 2**).

Table 2. Summary of study design, sample, setting, and key findings.

Title	Design	Sample	Setting	Key Findings
What about nudges in the process industry? Exploring a new safety management tool [11].	Explorative literature review.	150 nudge examples from scientific and grey literature across multiple domains.	Process industry (chemical and high-hazard sectors).	<ul style="list-style-type: none"> - Identified 30 nudge types; proposed 9 most relevant for safety. These include priming, defaults, social norms, commitment, salience, feedback, framing, emotion, and structuring complex choices. - Their effectiveness is yet to be proven.
Improving workplace safety by thinking about what might have been: A first look at the role of counterfactual thinking [12].	Longitudinal, prospective cohort field study with three waves of data collection.	240 healthcare employees (doctors and nurses) and 33 of their supervisors from a single hospital in Guizhou Province, China.	Hospital workplace setting in China.	<ul style="list-style-type: none"> - Upward counterfactual thinking was positively related to supervisor-rated safety compliance and participation. - Safety knowledge (but not safety motivation) mediated the relationship between upward counterfactuals and safety behaviors. - The positive effect of upward counterfactuals on safety behavior (through safety knowledge) was stronger for individuals with a high internal safety locus of control (the belief that they can personally control safety-related events).
An illusion of objectivity in workplace investigation: The cause analysis chart and consistency, accuracy, and bias in judgments [8].	Experimental between-subjects design.	Undergraduates: 285 (70 M, 215 F; age 17 - 46, M = 20.2) - Professionals: 72 (46 M, 17 F, 9 undisclosed; age 26 - 65, M = 44.7).	Computer-based simulation; undergraduates in labs, professionals remotely.	<ul style="list-style-type: none"> - CA Chart reduced accuracy in identifying causal factors compared to open-ended DMW. - CA Chart increased bias toward blaming the worker. - Professionals using CA Chart accessed less evidence than those using DMW. - Contextual bias (unsafe history) influenced cause attribution, especially for professionals. - Neither tool mitigated contextual bias effectively. - Evidence interpretation was biased toward supporting participants' own hypotheses.
Measuring base-rate bias error in workplace safety investigator [13].	Quasi-experimental between-subjects design with meta-analysis.	Professionals: n = 15 (forestry industry investigators) Undergraduates: n = 50 (control group).	Controlled environment using standardized booklets and presentation.	<ul style="list-style-type: none"> - Both groups showed human error bias. - Professionals showed stronger bias. - Participants were confident and believed they were objective, despite bias. - No correlation between confidence and actual bias.

Continued

Decision Making: How System 1 & System 2 Processing Affect Safety [14].	Conceptual article/expert opinion based on a literature review.	Not applicable. The article reviews concepts and does not report on a primary research study with a sample population.	Not applicable. The concepts are applied broadly to the field of occupational safety and health.	Decision-making is governed by two distinct processes: System 1 which contains inherent biases, such as overconfidence, confirmation bias, loss aversion, and neglect of ambiguity, which can compromise safety by leading to poor decisions. System 2 is Slow, deliberate, conscious, and allows for more analytical decisions.
Safety Disconnect: Analysis of the Role of Labor Experience and Safety Training on Work Safety Perceptions [15].	Analytical cross-sectional study.	773 individuals: 558 construction workers and 215 safety experts.	Construction sites and offices in Spain.	<ul style="list-style-type: none"> - Labor experience negatively affects risk awareness. - Safety training has a negative effect on workers' safety perceptions but a positive effect on experts. - Experts show over-precision bias due to formal training. - No significant over-estimation bias from experience found.
The impact of cognitive bias in safety [16].	Conceptual article/expert opinion based on a literature review.	Not applicable, as this is not a primary research study. The Article focuses on cognitive bias.	Process safety.	<ul style="list-style-type: none"> - Tools, processes, and accountability (e.g. pause and reflect, peer review, and executive oversight) are effective in reducing bias. - Specific biases such as status quo bias, sunk cost fallacy, confirmation bias, anchoring, hindsight bias, and others have been contributing factors in major incidents.
Using Scenarios to Align Safety Leadership [17].	Conceptual article/expert opinion based on a literature review.	Not applicable, as this is not a primary research study. The target audience is senior organizational leaders and executives.	Organizational leadership and workplace safety management across various industries.	<ul style="list-style-type: none"> - Cognitive biases such as anchoring, attribution error, in-group bias, often undermine safety decisions. - Scenario-based learning can help leaders recognize biases and align decisions with safety goals.
Human bias in the oversight of firms: evidence from workplace safety violations [18].	Quasi-experimental, observational study using exogenous weather variation as a natural experiment.	1,682,300 inspections conducted between 1972 and 2015 at 855,474 unique facilities by 121 unique OSHA office.	The context is workplace safety inspections of private-sector firms across the United States, as enforced by the Occupational Safety and Health Administration (OSHA).	<ul style="list-style-type: none"> - Sunny weather as a proxy for good mood was found to lead to fewer violations and lower penalties. The effect is stronger when officers have more discretion during non-routine inspections. - Effect is mitigated by stronger monitoring (proximity to regional offices). Slight increase in workplace accidents after so-called good-mood inspections.
Analysis of Cognitive Biases in Construction Health and Safety in New Zealand [19].	Systematic Literature Review (SLR) with Network Analysis.	45 articles (from 283 initially identified) published between 2018-2024.	Global construction industry (with emphasis on New Zealand context).	<ul style="list-style-type: none"> - The study identified 100 key decision-making factors and 64 distinct cognitive biases that influence health and safety in construction. - The most dominant factors were risk perception, overconfidence bias, optimism bias, and risk propensity.

Continued

POSITIVITY: Reversing the Negativity Bias [20].	Conceptual article/expert opinion based on a literature review.	There is no formal research sample. The target audience is Occupational Safety and Health (OSH) professionals.	The professional practice of safety and health within workplace organizations.	<ul style="list-style-type: none"> - Negativity bias is innate and affects safety practices. - Safety-II promotes proactive, positive approaches. - Reframing and focusing on strengths can improve safety culture. - Positivity supports collaboration and effective problem-solving.
Occupational safety management: The role of causal attribution [21].	Narrative Literature Review.	Not applicable. No primary data collected. The paper synthesizes findings from numerous cited studies with various sample.	The review draws on studies conducted in various organizational and industrial settings globally.	<ul style="list-style-type: none"> - Systematic bias exists: supervisors attribute accidents to internal factors (worker error), while workers attribute them to external factors. - Attributions are influenced by demographics (age, experience, culture, religion), organizational variables (safety climate, size), and cognitive biases (actor-observer effect, fundamental attribution error).
Tunnel Construction Workers' Cognitive Biases and Unsafe Behaviors: The Mediating Effects of Risk Perceptions [22].	Quantitative, cross-sectional study.	237 respondents from tunnel construction workers in China.	Tunnel construction projects on the Zhengzhou- Wanzhou railway, Chongqing Metro Line 9, and Changsha Metro Line 6.	<ul style="list-style-type: none"> - Cognitive biases (Availability, Confirmation, Overconfidence) are positively associated with unsafe behaviors. - Risk perceptions are negatively associated with unsafe behaviors. - Risk perceptions mediate the relationship between cognitive biases and unsafe behaviors.

Note. This table summarizes key findings for the included studies.

2.9. Critical Appraisal Process

To evaluate methodological quality and potential bias, all studies underwent critical appraisal using the appropriate Joanna Briggs Institute (JBI) checklists. The purpose of this appraisal was to assess the rigor of each study's design, conduct, and analysis. Specific checklists were matched to study designs; for example, the JBI Critical Appraisal Checklist for Systematic Reviews was used for systematic literature reviews, and the JBI Checklist for Text and Opinion Papers was applied to expert opinions and conceptual articles [23].

The risk of bias for each study was categorized as low, low to moderate, moderate, or moderate to high. The distribution of the risk of bias across the studies is as follows. (Table 3, Table 4)

Table 3. Summary of risk of bias.

Risk of Bias Category	Number of Studies
Low	4
Low-Moderate	4

Continued

Moderate	3
Moderate-High	2
High	0
Total	13

Note. This table summarizes the risk bias category for the included studies.

Table 4. Example of literature appraisal process.

Title	Tool for Appraisal (Inclusion)	Risk of bias
Improving workplace safety by thinking about what might have been: A first look at the role of counterfactual thinking	Include based on overall score using JBI Critical Appraisal Checklist for Cohort Studies.	Low to moderate
An illusion of objectivity in workplace investigation: The cause analysis chart and consistency, accuracy, and bias in judgments	Include based on overall score using JBI Checklist for Quasi-Experimental Studies.	Low to moderate

Note. This table exemplifies how risk of biases was assessed and categories using JBI tools appropriate for the study design.

3. Discussion

The systematic review aimed to comprehensively explore cognitive biases and their debiasing strategies within the context of OSH. The findings underscore the influence of cognitive biases across various facets of the OSH professions including accident causation, workplace safety decision-making, hazard perception, and their role in the efficacy of management systems.

The synthesis of the results revealed a pattern of specific cognitive biases that recurred across OSH settings. In the context of accident causation, for example, biases like the actor-observer effect, fundamental attribution error, and self-defensive attributions were consistently implicated in how causes were attributed [21]. Regulatory inspections proved susceptible to contextual influences and confirmation bias [8], potentially influencing enforcement decisions [18]. In workplace safety decision-making, complex systems and increased information processing often fostered overconfidence and optimism bias, leading to skewed risk perception. Furthermore, hazard identification was frequently influenced by confirmation bias, resulting in overlooked hazard warnings [19].

Finally, safety management systems themselves were often undermined by reductionist perspectives of bad actors, bad behavior theory, over quantification, and hindsight bias [7] [11].

While the prevalence and impact of cognitive biases are well documented, this SLR reveals a significant gap concerning the development and evaluation of debiasing strategies within the context of OSH. The SLR on cognitive biases and debiasing strategies yielded only 13 relevant papers, which suggests a significant gap

in the literature and highlights the need for further research on debiasing strategies across various safety domains.

Reflecting the limited evidence base identified (only 13 relevant studies), this SLR is inherently limited by the current availability of research. However, it offers valuable initial insights by identifying debiasing strategies that are utilized and presenting preliminary evidence of their effectiveness. For instance, standardized checklists, despite their intention to promote objectivity, have been found to be ineffective and even counterproductive [8]. In contrast, strategies focusing on deliberate design that promote a structured approach show more promise. Two key tools in this approach are premortem analysis, which actively counters biases by anticipating failure points, and scenario-based learning, which encourages comprehensive data review and challenges assumptions. Furthermore, Kerin [16] highlights that because unconscious biases operate at a subconscious level, interventions to counter them must go beyond basic training. This aligns with Lafuente, Abad [15] findings that advocate for tailored training programs that are directly applicable to real-world operational challenges.

The narrative synthesis of this SLR not only revealed some areas of consistency and familiarity for the occurrence of cognitive biases in the OSH domain, but also served to highlight the gap in debiasing strategies. This narrative is structured around emergent thematic categories derived from empirical and experiential data, reflecting salient aspects of the implications of cognitive biases within the OSH industry.

3.1. Cognitive Biases in the Occupational Safety and Health Industry

3.1.1. Cognitive Biases in Accident Causation

Causality for accidents has long been an interest in the OSH industry in part to develop accident prevention strategies. Gyekye [21] found that cognitive biases systematically distort any instance of accident causation during accident investigation. Key biases identified by the author include, actor-observer effect, fundamental attribution error, and self-defensive attributions. These biases negatively affect safety policies that result in targeting the individual worker rather than systemic issues, and potentially increase accident recurrence.

Similarly, regulatory inspections were also affected by cognitive biases. Maclean and Dror [4] explain that people tend to make attributions quickly in part due to contextual information that serve as anchor. Additionally, they found that investigators often seek evidence that supports their initial hypothesis while ignoring contradictory evidence.

Molocznik [20] suggests that negativity bias has several implications for the OSH industry. For example, the lack of impartiality and accusatory approach of incident investigations can be attributed, in part, to this bias. Furthermore, focusing solely on what goes wrong undermines any organizational effort on learning from normal work and successes.

3.1.2. Cognitive Biases in Workplace Safety Decision-Making

Purushothaman *et al.* [19] explored how cognitive biases shape decision-making in the OSH within the construction industry. Their research indicates that increasing system complexity forces workers to process larger volumes of information, which in turn allows cognitive biases to distort risk perception. This fosters a greater willingness to take risks in the workplace. Furthermore, the study highlights a compounding effect among biases, such as how overconfidence can exacerbate optimism bias, that ultimately heightens risk-taking and amplifies this behavior [17].

Workplace safety compliance officers are also not immune to cognitive biases when it comes to decision-making. Heese *et al.* [18] found that the frequency of safety violations and total monetary fines levied decreased during sunny weather. Crucially, this effect was more pronounced when enforcement agents exercised greater discretionary judgement. This difference likely arises from the structure inherent in routine inspections, which follow specific formats and provide a framework for decisions. On the other hand, non-routine inspections lack predetermined plans; it is in these less structured situations that the study found mood exerts a stronger influence on enforcement outcomes.

3.1.3. Cognitive Biases in Hazard Perception

One of the important facets of an OSH professional's role is hazard identification. Cognitive biases also have a specific influence when it comes to worker risk perception and proactive hazard identification. For example, in construction scenarios confirmation bias could lead to overlooked warnings or relying on assumptions that current controls are sufficient, leading them to disregard introduction of new hazards or resist changes to new safety standards [19].

How risk is assessed also varies depending on the type of role and the distinct types of knowledge workers have. Lafuente *et al.* [15] found that workers grounded in experiential knowledge often exhibit a tendency to underestimate risks while overestimating personal capabilities (overconfidence bias). On the other hand, workers trained through formal programs typically prioritize hazards based on severity classifications, potentially overlooking the probabilistic assessment of routine workplace risks [22].

Furthermore, Maclean and Read [8], found that in a scenario based on incident investigation, both undergraduates and safety professionals exhibited bias in identifying hazards for workplace incidents leading them to disproportionately focus on human error.

3.1.4. Safety Management Systems

Fundamentally, safety management systems are built upon principles of organization, human behavior, and system safety. Reiman and Rollenhagen (2010) argue these approaches are often undermined by systemic biases rooted in a reductionist perspective that isolates human elements rather than adopting a systems view. Specific examples include trait-based attribution of error such as the bad apples

theory, prioritizing quantifiable metrics over contextual insights (over-quantification), and when opportunities for improvement are only revealed after an incident (hindsight bias).

He, Payne [12], found that downward counterfactuals (imagining the worst outcome) contribute to cognitive biases like negativity biases in safety contexts. While this focus on negative possibilities can foster awareness and resilience planning, leadership that exclusively emphasizes negative outcomes risks creating a reactive safety culture and missing opportunities for proactive safety engagement.

Human error and unsafe behavior have long been a central focus of safety management, dating back to foundational work like Heinrich's in the early 1900s [24]. Building on this understanding, modern research like that of Lindhout and Reniers [11] identifies cognitive biases such as status quo bias, availability bias, and illusion of control as fundamental contributors to distorted risk perception and decision-making in process safety management. They also note that accident causality increasingly points to unsafe acts and that organizational factors are the last problem to solve. This human-centered aspect, while dominant in accident causation, is typically addressed only after technological safeguards and management systems have been introduced. Furthermore, these inherent cognitive biases persist until surfacing post-incident, revealing gaps in proactive risk mitigation.

3.2. Frameworks for Addressing Cognitive Biases in Occupational Safety and Health

3.2.1. Standardized Checklists

Addressing biases is crucial for an effective workplace safety strategy. Unconscious assumptions about worker's capabilities, backgrounds, roles, can lead to blindspots. Mclean *et al.* [8] studied the effectiveness of a structured checklist (cause analysis chart) with predefined causal options as a debiasing tool in workplace investigations and found it ineffective and counterproductive. Compared to open-ended forms, these checklists failed to mitigate contextual biases. Additionally, professionals using these checklists also had a tendency to evaluate the evidence less thoroughly. Their findings suggest that despite the intention to standardize decision making, checklists can actually promote bias rather than reduce it. They note that effective debiasing requires actively blocking biasing information upfront (e.g. hiding irrelevant information) or linear sequential unmasking that progressively reveals information as needed.

3.2.2. Awareness and Bias Mitigation

Cardar and Ragan [14] suggest using Kahneman's dual process approach to address cognitive biases. This framework distinguishes intuitive, automatic thinking (System 1), from deliberate, critical thinking (System 2). To overcome System 1 biases, they propose premortem analysis: hypothesizing the worst possible failure and developing solutions in advance.

Spigener [17] argues that scenario-based learning (SBL) is a crucial tool to gain awareness and to mitigate cognitive biases such as recency bias, anchoring, sunk-

cost bias, and overconfidence, that influence safety professionals. These scenarios introduce principles and practices to develop decision-making skills. For instance, developing a scenario that reviews multi-year data to counter focusing exclusively on readily available data (recency bias) or utilizing counterarguments to explore alternatives and challenge assumptions of established processes (anchoring).

3.2.3. Structured Training Programs

Kerin [16] argues that while education about unconscious bias is necessary, it is insufficient on its own because biases operate subconsciously and persist without structural safeguards. The author advocates for a deliberate system design that incorporates a structured approach beyond awareness training specific to countering bias. For instance, for status quo bias, the recommendation to counter it is to have someone challenge the ideas. Another example is engaging someone external to challenge confirmation bias.

Specific safety-derived recommendations include slowing down to look for more data and to force a pause for reflection, implementing corrective actions to diagnose root causes, and embedding accountability and oversight processes that objectively challenge decision-making.

Lafuente *et al.* [15] suggest that organizations can improve workforce management and reduce the safety disconnect by designing customized training programs that acknowledge the different operational realities faced by workers and safety experts.

4. Limitations

This SLR, like any research, faces inherent limitations. First, the word selection for the search strategy was based on the author's review and knowledge of the domain, as a result the selection may not have captured the full breadth of relevant literature, potentially introducing selection bias [9]. Second, it is important to acknowledge publication bias, where a greater likelihood of publishing studies with significant results may have led to the exclusion of those with less conclusive findings [9]. Lastly, substantial methodological heterogeneity among the included studies precluded quantitative meta-analysis. Consequently, the findings were synthesized qualitatively; while this approach accommodated the diverse evidence, it inherently limits the ability to statistically assess the findings.

5. Conclusions

The influence of cognitive biases across various domains of occupational safety and health, including accident causation, workplace safety decision-making, hazard perception, and the effectiveness of safety management systems, has been studied and established. Despite the well-documented existence and influence of these biases, a research gap exists in the development and evaluation of debiasing strategies within OSH context. This review focused on cognitive biases and debiasing strategies. Utilizing the PRISMA approach for literature review resulted in

only 13 relevant articles. This firmly establishes the need for continued empirical exploration and implementation of targeted debiasing interventions to enhance safety outcomes.

The available research offers initial insights, suggesting that standardized checklists may prove ineffective or even counterproductive, while strategies centered on deliberate system design, such as premortem analysis and scenario-based learning, and structured training demonstrate greater promise.

This narrative synthesis of the review underscores both the consistent presence of cognitive biases in OSH and the critical need for further research into effective debiasing techniques in OSH.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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