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Review Article

Systemic factors in workplace accidents: An umbrella review of series injuries and fatalities

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A B S T R A C T

Increasingly the complexities of organisational systems and the systemic nature of serious workplace injuries and fatalities are characterised by unpredictable outcomes. A complex systems thinking approach is needed to identify and analyse system interactions and systemic causal factors to explore the connections between people, technology and organisational systems and the incidence of workplace accidents.

This umbrella review aimed to analyse the peer-reviewed systematic review literature related to accident causation for serious workplace accidents and fatalities to develop an understanding of the systemic causal factors across a range of complex systems. Some electronic databases were searched using the key search terms "accident causation factors", "accident*", "fatalit*", "work*" and their variations between 2000 and 2022. The selected papers underwent screening, eligibility and quality appraisal process using checklist for systematic reviews and research syntheses.

Following the systematic process, a total of 13 papers were included in the total data set. The studies originated from a variety of workplaces such as industry, aviation, mining, maritime and construction industries. The most common contributing factors were sleep deprivation, fatigue and substance abuse whereas organisational factors such as management systems, resources and equipment as resulting in significant workplace incidents.

This review identified that human errors and organisational and system factors were the main source of accident causation across multiple industries. The importance of learning from incidents and need for more sophisticated reporting systems was identified as being essential to change workplace culture and safety.

1. Introduction

The safety profession is increasingly recognising the complexity of organisational systems and the systemic nature of serious injuries and fatalities (Salmon et al., 2012). A serious bodily injury in this context is defined as "a bodily injury which involves substantial risk of death, protracted and obvious disfigurement, or protracted loss or impairment of the function of a bodily member or organ or mental faculty" (Merriam-Webster, n.d.). Complex systems are characterised by unpredictable outcomes due to non-linear, dynamic cause and effect interactions between connected elements, such as people and technology (Read et al., 2021). Within this context, an accident is most likely to occur due to unpredictable interactions between people and technology rather than due to the failure of an individual component (Dekker, 2016). Complex systems therefore require new ways to investigate what went wrong across a system, incorporating this complex systems thinking (Dekker, 2016). Contemporary accident investigation methodologies enable an identification and analysis of systems interactions and systemic causal factors across all levels of the system within which an accident occurred. There remains a gap in the current theoretical approaches as evident in the lack of synthesis across diverse industry domains, making it difficult to apply any of the four current methodologies in practice. In order to explore what is currently known about the causation factors related to serious injuries and fatalities an Umbrella review using the Joanna Briggs Institute methodology was conducted (see Figs. 1 and 2).

The four leading methodologies are, AcciMap developed out of early work by Rasmussen (Rasmussen, 1997), Functional Resonance Analysis Model (FRAM) (Hollnagel, 2012), Human Factor Analysis and Classification System (HFACS) (Wiegmann, 2007) and Systems Theoretic Accident Model and Process (STAMP), developed by Leveson (2004). The AcciMap (Rasmussen) models the way decisions and actions made at higher levels of a system can indirectly influence events occurring on the frontline. These decisions may be distant in time and space, such as a legislative requirement, however the AcciMap clearly displays the interconnectedness of these levels and their influence as causal factors

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