Ethical and Social Risks of Using Exoskeletons in Construction

Virtual Boundaries: Investigating the Ethical and Social Risks of Exoskeletons in the Construction Industry

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Overview

Exoskeletons are used increasingly within the construction industry to help workers regularly exposed to physically demanding and repetitive activities. While previous studies have examined the health and safety risks of exoskeletons in construction, there is a significant gap in the literature regarding their ethical and social risks. This study addresses that gap by investigating ethical risks related to issues such as design, autonomy, discrimination, and privacy, as well as social risks that include affordability, unauthorized access, dependency, and social identity. The study both identified these risks and explored how exoskeletons can be designed to minimize them. The researchers used a mixed-method research design of a Delphi study (with three rounds of surveys of construction practitioners and researchers), literature reviews, and focus groups. Based on their findings, they also developed a practical guide to aid the ethical implementation of exoskeletons so workers are better protected.

Key Findings

- Out of an initial list of 34 ethical and social risks, the Delphi study experts verified 18 as significant hazards. The 18 verified risks fell into seven categories: design, autonomy, dehumanization, stigmatization, trust, affordability, and accessibility.
- Passive exoskeletons are suitable for repetitive overhead work and awkward postures. For example, back-support exoskeletons are most suitable for trades such as plumbers and carpenters, and shoulder-support exoskeletons were recommended most often for carpenters, drywallers, electricians, HVAC technicians, and plasterers. Full-body exoskeletons are better suited for laborers.
- Active exoskeletons are better for heavy lifting, such as the kind of work done by rebar workers and laborers.
- Obstacles to addressing risks varied based on categories. Hindering the mitigation of design risks, for example, were factors such as the high cost of lighter power systems and limited user training. Cost and expertise were also challenges in terms of affordability and accessibility. For autonomy, privacy, and stigmatization risks, the complexity of data protection regulations and restrictions from exoskeleton manufacturers posed significant obstacles.

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 Production of this document was supported by cooperative agreement OH 009762 from the National Institute for Occupational Safety and Health (NIOSH). The contents are solely the responsibility of the authors and do not necessarily represent the official views of NIOSH.

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