

# Using AI to Address Demographic-Specific Challenges in Manual Handling Safety

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## **ABSTRACT**

*This chapter explores the application of Artificial Intelligence (AI) in addressing demographic-specific challenges in manual handling safety, focusing on age, gender, and physical capability variations in the workforce. The chapter examines AI-driven ergonomic solutions, predictive analytics, and adaptive training programs. It highlights case studies showcasing AI's role in reducing injury rates and enhancing safety protocols tailored to diverse worker demographics. The discussion concludes with the potential for AI to revolutionise occupational health and safety, ensuring equitable and personalised interventions in manual handling practices.*

## **1. INTRODUCTION**

### **1.1 Overview of Manual Handling Challenges in Diverse Workforce Demographics**

Manual handling tasks are a significant source of workplace injuries, particularly in industries that rely heavily on physical labour. The challenges associated with manual handling are exacerbated by the diverse demographics of the workforce, which includes variations in age, gender, and physical capability. Older workers, for instance, may experience a decline in physical strength and flexibility, making them more susceptible to injuries during manual handling tasks (Liu et al., 2020; Horta Reis da Silva, 2022a). Similarly, gender differences can influence physical capabilities and ergonomic needs, with studies indicating that women may face unique challenges in manual handling due to differences in body mechanics and strength compared to their male counterparts (Mirbabaie et al., 2021). Furthermore, workers with varying levels of physical capability, including those with disabilities, may require tailored approaches

to manual handling to ensure their safety and effectiveness in the workplace (Pishgar et al., 2021; Horta Reis da Silva, 2022b). The implications of these demographic variations are profound, as they necessitate a reevaluation of existing manual handling protocols and safety measures. Traditional one-size-fits-all approaches to manual handling training and safety may not adequately address the specific needs of a diverse workforce, potentially leading to increased injury rates and decreased productivity (Guzman et al., 2022). Therefore, understanding the demographic-specific challenges in manual handling is crucial for developing effective occupational health and safety strategies that promote the well-being of all workers (Horta Reis da Silva, 2022a).

## **1.2 Introduction to AI's Role in Occupational Health and Safety**

Artificial Intelligence (AI) has emerged as a transformative force in various sectors, including occupational health and safety (OHS). AI technologies can analyse vast amounts of data to identify patterns and predict potential hazards, thereby enhancing workplace safety (Shankar et al., 2022). For instance, AI-driven predictive analytics can be employed to assess the risk factors associated with manual handling tasks, allowing organisations to implement preventive measures tailored to the specific demographics of their workforce (Kim, 2020). Moreover, AI can facilitate the development of adaptive training programs that cater to the unique needs of different worker demographics, ensuring that all employees receive the necessary skills and knowledge to perform manual handling tasks safely (Sharma, 2023). The integration of AI into OHS practices also holds the potential to revolutionise how organisations approach safety management. By leveraging AI technologies, companies can create more dynamic and responsive safety protocols that evolve based on real-time data and feedback from workers (Wagner & Schöne, 2020). This adaptability is particularly important in diverse work environments, where the needs and capabilities of the workforce can vary significantly. As such, AI not only enhances the effectiveness of safety interventions but also promotes a culture of safety that is inclusive and equitable for all employees (Howard, 2024).

## **1.3 Purpose and Scope**

The purpose of this chapter is to explore the application of AI in addressing demographic-specific challenges in manual handling safety. By examining the intersections of age, gender, and physical capability within the workforce, this chapter aims to highlight the importance of tailored safety interventions that consider the unique needs of diverse worker populations. The scope of the chapter includes an analysis of AI-driven ergonomic solutions, predictive analytics, and adaptive training programs designed to enhance manual handling safety across various demographic groups (Fisher et al., 2023). Additionally, this chapter will showcase case studies that illustrate the successful implementation of AI technologies in reducing injury rates and improving safety protocols. These case studies will provide concrete examples of how AI can be leveraged to create safer work environments that accommodate the diverse needs of the workforce (Fukumura et al., 2021). Ultimately, the chapter will conclude with a discussion on the potential for AI to revolutionise occupational health and safety practices, ensuring that all workers, regardless of their demographic characteristics, can perform manual handling tasks safely and effectively (Mariani & Lozada, 2023).

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