Harnessing AI to Increase Workplace Safety

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Canadian Home Builders' Association - Newfoundland and Labrador

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Executive Summary

Introduction

The residential construction sector in Newfoundland and Labrador is a significant contributor to the region's economy, comprising 31% of construction employment, with 8% focused on new housing and 23% on residential renovation (Build Force Canada, 2024). However, as the demand for residential construction increases, a forecasted shortage of qualified workers poses additional safety risks in an industry where workplace incidents and injuries are already prevalent. This research project was designed to explore the linkages between worker and organizational safety behaviors (through qualitative and quantitative data) and incident patterns within this sector, with the goal of developing an algorithm that could predict workplace incidents and accidents. By leveraging data analytics, the project aimed to provide new insights to support occupational health and safety (OHS) in the province.

Research Objectives

The project sought to address two primary research questions:

1. Behavioral Linkages: What specific behaviors or patterns of behaviors (organizational and individual) can be linked to workplace incidents, accidents, and injuries within the residential construction sector, and how can these insights be used to enhance an OHS program?

2. Algorithm Development: Can an algorithm developed in this study accurately identify behaviors in safety data that lead to incidents and accidents?

Project Rationale

Sectors and organizations worldwide are collecting and analyzing increasing amounts of data, the potential to use these insights to improve safety outcomes in industries such as residential construction is immense. Companies are already using big data in various domains such as customer behavior, healthcare, and supply chain management to reveal patterns and trends that were previously undetectable (Marr, 2018; Bradlow et al., 2017; Wang et al., 2018; Waller and Fawcett, 2013). In the context of occupational health and safety (OHS), big data and analytics hold promise for predicting and preventing workplace injuries. For instance, Goldcorp, a gold mining company, used data analytics to examine safety incidents and operational data, uncovering relationships between various factors and injury rates (Stewart, 2013). Despite the widespread data collection, a significant portion of collected data remains unanalyzed, often referred to as "dark data" (Gualtieri, 2016; Schembera and Durán, 2020). This research project aimed to address similar challenges within the residential construction sector by exploring the feasibility of predictive analytics for incident prediction and prevention.

Project Limitations

While the research was ambitious in its scope, several limitations impacted the ability to fully achieve the project's objectives:

1. Participant Access: Securing participants for interviews and surveys from the residential construction industry proved challenging. Many organizations in this sector are micro (1-9 employees) or small enterprises (10-50 employees) with limited capacity to engage in research activities, which constrained the collection of qualitative data. The limited engagement from industry stakeholders, though understandable, affected the breadth of data that could be gathered.

2. Data Accessibility: The availability of both leading and lagging indicator data for the incident prediction model was limited. Comprehensive workplace incident statistics are not systematically collected by federal and provincial governments, and provincially, workplace audits and associated data are not digitized. This lack of digitization and systematic data collection posed significant challenges in gathering the necessary data for the algorithm. Additionally, data provided by WorkplaceNL excluded unreported or unaccepted claims, and was limited to incidents that resulted in a monetary payout. These limitations further hindered the development of a predictive model.

3. Data Protection: The protection of personal health information under the Personal Health Information Act (PHIA) required de-identification before public release, which limited the number of claims and variables available for analysis, such as age, date of incident claim, nature of injury, and the event leading to injury. This necessary step, while crucial for privacy, reduced the richness of the dataset, further complicating efforts to develop a predictive algorithm.
4. Competency Model: Although the project faced limitations in data collection that prevented the full development of a predictive algorithm, the information gathered throughout this project was utilized to tailor a competency model for the residential construction sector. This model incorporates key competencies specific to behavioral-based safety, drawing on both new insights from the project and previous work by TW, including a comprehensive training assessment completed for CHBA-NL in 2017. While not a predictive tool, the competency model provides a foundation for identifying critical safety behaviors and can be further refined over time to enhance the understanding and prediction of behaviors that contribute to incidents and accidents.

Despite these limitations, the research project provided information on the current state of health and safety data within Newfoundland and Labrador's residential construction sector. The primary goal of developing a predictive algorithm for workplace incidents was not fully achieved, largely due to the limited availability and format of the necessary data. However, the project has laid a foundation for future research by identifying gaps that must be addressed to realize the potential of predictive analytics in this field.

Moreover, the creation of the competency model offers a practical tool that regardless of its predictive capability, can be used to enhance safety programs in the sector.

To advance the development of predictive models in the residential construction sector, future efforts must focus on improving data collection practices. This includes ensuring the data is collected in a comprehensive, detailed, and digitized format, which is essential for effective data analysis. Additionally, greater coordination between industry stakeholders will be crucial to gather the necessary data and insights to support the development of robust predictive algorithms.