National Safety Council | MSD Solutions Lab an nsc program

Leveraging Emerging Technologies for Injury Surveillance: A Proposed Smart Injury Surveillance System

While organizational injury surveillance may currently have its challenges, there is an **increase in available technologies** to assist with such reporting. The effective and innovative use of information technology is vital to a successful and smarter surveillance system.[1] This approach includes the automated coding of occupational data across relevant records, electronic reporting from both traditional and emerging sources, and the development of hardware and software for simplified, efficient, and real-time data collection. The National Academies further emphasizes that to fully realize a system's potential, new methods and tools must be created for the timely collection and analysis of surveillance data. Additionally, software should be designed and made accessible to all relevant stakeholders, enabling them to independently analyze surveillance data and quickly act on findings to enhance worker safety and health.

Leveraging emerging technologies can significantly reduce incident underreporting by capturing events, including near misses, as they happen. This proactive approach minimizes the need for employees to self-report injuries later, a process often hindered by many factors, as explained previously. These technologies ensure more accurate and timely documentation by fostering immediate reporting and improving safety outcomes. However, smaller organizations may face challenges in scaling artificial intelligence (AI) models or using Internet of Things [IoT] sensors to develop data-driven interventions. Resource limitations may also hinder advanced system integration and data management. Thus, organizations should evaluate and selectively adopt technological elements that fit their operational capacity and technology readiness.

Since Industry 5.0 emphasizes collaboration between workers and automation (e.g., using technologies like IoT, big data, cloud connectivity, and analytics powered by AI and machine learning [ML]), **harnessing algorithm-driven intelligence** and other emerging technologies presents a powerful opportunity to leverage strengths, enabling the development of smarter injury surveillance systems to meet the evolving needs of various stakeholders. The NIOSH surveillance briefing document also emphasizes that a robust surveillance program should identify emerging illness, injury, or exposure issues, track trends over time, guide priority setting, and evaluate the long-term impact of research and interventions.[2]

Considering these ideas from the National Academies, Holder and colleagues,[3] the arrival of human-centric Industry 5.0, and insights from the NIOSH surveillance program, a smart workplace surveillance system is proposed here in the figure below and is explained in more detail in the **accompanying report**.[4]

1. National Academies of Sciences, Engineering, and Medicine. 2018. A Smarter National Surveillance System for Occupational Safety and Health in the 21st Century. Washington, DC: The National Academies Press. doi: https://doi.org/10.17226/24835
2. National Institute for Occupational Safety and Health. (2016, May). NIOSH surveillance program (DHHS publication No. NIOSH). National Institute for Occupational Safety and Health. https://stacks.cdc.gov/view/cdc/40563
3. Holder, Y., Peden, M., Krug, E., Lund, J., Gururaj, G., & Kobusingye, O. (2001). Injury Surveillance Guidelines. Geneva: World Health Organization. https://stacks.cdc.gov/view/cdc/6456/cdc_6456_DS1.pdf
4. Maikala et al. (2025). The Importance of Musculoskeletal Disorder and Related Injury Surveillance: An Organizational Approach. National Safety Council. https://www.nsc.org/faforms/msd_injury_surveillance_report

A Smart Workplace Injury Surveillance System

Workplace Systems Integration

- Enterprise resource planning-integrated occupational health and safety (OHS) management system
- Integrated data exchange: incident reporting, claims, return-to-work, medical and compliance tools
- Integration of AIoT devices with OHS management system
- Real-time monitoring dashboards: lagging and leading indicators
- Customizable visual analytics and metrics for stakeholders
- AI-driven insights for EHS and C-suite decision-making

Automated Coding of Incidents

- Standardize occupational codes for injuries
- Machine learning and natural language processing for coding job descriptions and injury reports

Data Integration & Management

- Flexible data storage: cloud for real-time access, local for offline/backup
- Secure data solutions: encryption and role-based access control
- Data sharing: application programming interface Integration with enterprise resource planning systems

Reporting of Incidents

- From traditional sources: injury reports, OSHA 300/300A/301, etc.
- From emerging tech sources (e.g., IoT devices and wearable sensors)

AI-Powered Risk Assessment

- Artificial intelligence of things (AIoT)-powered data analysis and risk prediction
- Computer vision for pattern recognition risk scores
- Real time data-driven decision making and actionable insights
- Predictive analytics (worker-based, task-based, and workplace-based)

Data Collection

- Worker data
- Task data
- Workplace data

Supervisor/EHS Manager/Ergonomist

- Real-time reports: worker, task, workplace metrics and MSD risks
- AI-driven alerts for physical/psychological risk factors
- AI-driven alerts for high-risk work/workers
- Proactive alerts based on predictive analytics
- Insights on ergo interventions; priority setting for risk mitigation

Note: Dotted double-headed arrow signifies a two-way relationship between individual modules; facilitating continuous improvement between modules