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Workplace safety analytics
Save lives and the bottom line

The workplace safety conundrum

Leading organizations have spent years implementing robust programs stressing strong safety cultures, management accountability, monitoring of leading and lagging safety metrics, education, training and communication.

These programs range from compliance-based safety committees discussing employee concerns about workplace safety, to management systems and supporting control programs aligned with internationally-recognized safety management standards, such as CSA Z-1000 or OHSAS 18001. Organizations with strong safety management systems frequently embed safety into their core values, which are visibly embraced by corporate leadership. Often, they even work to build a safety culture by introducing behavioural safety programs that target safety outside of the workplace and at home.

Yet, despite this level of investment, many organizations have seen their safety performance plateau, and continue to experience serious safety incidents and fatalities. This creates a struggle to determine the next, best safety intervention and to assess if the current interventions are living up to their potential.

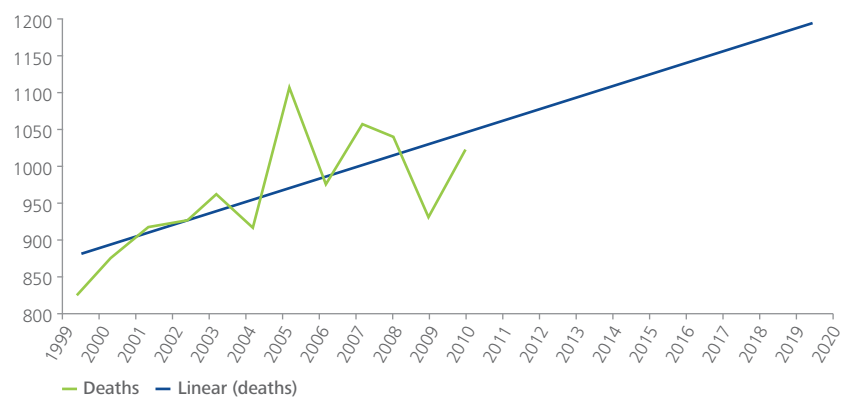
Reputation risk

The impact to a corporation's reputation as a result of frequent workplace injuries or fatalities is significant. The media are quick to name organizations when workplace incidents occur, driving companies to implement a range of damage control strategies, including:

- **Frequent** communications to restore public trust
- **Product** re-branding and repositioning to increase customer churn
- **Opportunity** cost of lost business prospects and partnerships
- **Increased** cost of capital due to lower credit rating
- **Replacing** executives and managers who resign, and skilled talent who leave as a result¹

While the overall frequency of workplace incidents is declining, workplace fatalities in Canada continue to rise. According to the Association of Workers' Compensation Boards of Canada, workplace fatalities increased from 842 in 1999 to 1,039 in 2010, representing a 25.9% increase,² – despite the fact that the eligible workforce increased by only 15.5% for the same period.³ This is an alarming trend, particularly for organizations that are already the target of heavy scrutiny from various stakeholder groups, such as those in the oil and gas, mining and forestry sectors.

Figure 1 - Trending of workplace fatalities in Canada



Talent risk

Frequent or severe workplace incidents can also seriously erode an organization's talent base – and the human cost of safety has an impact far beyond those injured. Beyond the negative effects to employee morale, safety concerns often prompt increased turnover, lower productivity and a flagging organizational commitment to safety.

While the immediate impacts on talent can be high, the longer-term impacts can be greater still. Many labour-intensive industries (such as the extractive sector) are seeking to dramatically increase scale in coming years. With demographics leading to a declining pool of resources, competition for talent promises to increase significantly. Organizations with spotty safety records will find themselves losing out in the war for talent, limiting their ability to meet growth targets and promote shareholder value.

According to a report by the Conference Board of Canada, "organizations that provide a healthy workplace are also more attractive to prospective employees. Top talent is looking for 'employers of choice' and the majority of employers that fall into this category put an emphasis on building healthy work environments."⁴

Financial risk

Workplace injuries cost Canadians nearly \$20 billion annually.⁵ While claims for total lost time decreased in absolute number by 22% between 1999 and 2010, benefit costs soared by over 47% for the same period.⁶ Although public sector insurers temporarily absorb these direct costs, they subsequently partially redistribute them by increasing premiums for higher-risk employers. Publicly run insurers are also feeling the strain to remain fully funded in the face of increasing benefits costs.⁷

Direct financial costs of workplace incidents include medical insurance premiums, additional lost time compensation payments and sanctions levied by workers' compensation boards where organizations are found to be negligent. Indirect costs arise from lost productivity, hiring and re-training, accident investigation, repairs to plant and equipment and HR costs associated with lower employee morale and absenteeism.⁸ Companies can also incur significant additional costs if they must substantially change existing processes to implement recommendations that stem from accident investigations.

To get a sense of the magnitude of both direct and indirect costs related to workplace safety incidents, consider these examples:

Sources, costs and opportunities to mitigate financial risk

Sources	Costs	Opportunities
Sanctions	<ul style="list-style-type: none"> A workers' compensation board (WCB) issued fines totalling \$4.9M in 2011, with the highest penalty imposed over death at a blasting site⁹ 	<ul style="list-style-type: none"> Cost avoidance in terms of recruiting, fines and the impact of negative publicity
Premium increases	<ul style="list-style-type: none"> The direct cost ([WCB] premiums) of a new lost time injury (LTI) (in 2007) was \$21,300¹⁰ A workers' compensation board was able to increase premiums 100% due to poor experience¹¹ 	<ul style="list-style-type: none"> Premium is reduced by WCB when the number of claims decreases year-over-year WorkSafe BC can provide a discount of 50% of premium for good experience
Claim costs (US)	<ul style="list-style-type: none"> Employers pay almost \$1 billion per week for direct workers' compensation costs alone¹² Workplace injuries and illnesses in 2009 totalled \$50 billion in direct U.S. workers' compensation costs¹³ 	<ul style="list-style-type: none"> Direct cost accumulates in the terms of both healthcare premiums and compensation costs Reducing workplace accidents reduces premiums and compensation costs, and frees up cash for investment and growth
HR/productivity costs	<ul style="list-style-type: none"> Indirect cost of each LTI (in 2007), including re-hiring, re-training, and lost productivity was \$85,200¹⁴ 	<ul style="list-style-type: none"> Employee engagement, job satisfaction and commitment have been shown to empirically improve occupational safety as well as productivity¹⁵
Litigation	<ul style="list-style-type: none"> A jury returned a verdict of \$14 million ...it was alleged that Occupational Safety and Health Administration fall protection regulations were not enforced and compliance was not required¹⁶ Jury awards \$82.5M in workplace death lawsuit¹⁷ 	<ul style="list-style-type: none"> Cost avoidance due to litigation attributed to negligence claims in avoidable safety incidents

Safety analytics

Leverage data to promote better safety outcomes

As the severity and cost of claims continues to rise, it is imperative for organizations to take a closer look at their existing workplace safety programs.

Current practice in even the most advanced safety-oriented organizations generally involves the analysis of historical safety incident data to identify potential trends. This largely relies on the analysis of lagging indicators and is limited to data directly related to the incident itself. This type of reporting and analysis can describe what happened, but not why.

To get to the root of the problem, organizations need a way to identify the potential “causal factors” of a safety incident and, on the basis of those factors, predict the likelihood of future incidents before they occur. The clues to finding causal factors, however, are frequently hidden in variables not captured in incident reports – such as equipment operation and process data, vehicle telemetry, weather, geospatial, socio-demographic, human resources (payroll, performance data) and training, industry and other data.

This is where advanced analysis comes in. Through the application of predictive modeling techniques, organizations can begin to identify the driving factors of workplace incidents with the goal of developing effective prevention strategies. Ever-increasing levels of access to inexpensive storage and technology make it easier to sift through workplace data to find these clues. Yet, in light of siloed data management practices, most organizations don't know where to begin to leverage the data they have.



New data sources deliver new insights

Companies today have an unprecedented opportunity to leverage disparate data sources and commercially-viable analytic tools to support and inform their strategic safety decisions.

This enables organizations to extend their analysis beyond conventional injury case management reports to other data sources not directly associated with workplace safety.

Fusing disparate data sources can also help organizations view workplace safety incidents from a variety of different analytic perspectives. Rather than analyzing workplace safety from a traditional employee-focused perspective by trying to determine, for example, what employee attributes contributed to the incident (e.g., fatigue, training and engagement, age, tenure), companies can begin to focus on other parts of the workplace ecosystem to construct a more holistic model of the incident.

By refocusing the analytic perspective, organizations can consider variables such as weather, aspects of the job site, maintenance schedules, production measures, financial data, etc., to identify other causal factors not associated with the worker at all. This positions companies to take preventative actions to reduce the non-worker related risk, such as adjustments to equipment maintenance schedules, placement of machines and vehicles or scheduling of particular tasks at different times of the day.

Examples of safety analytic data sources

Safety data	HR data	Context setting	External
HSE efforts	Rosters	Incident context	Stakeholder benchmarks
Audits	HSE history	Task variation	Culture
Investigations	Performance history	Site variation	Sociodemographic
Incidents	Training skills	Equipment	Geospatial
	HRIS profile	Production complexity	Time of day
			Weather

A new way to view safety incidents

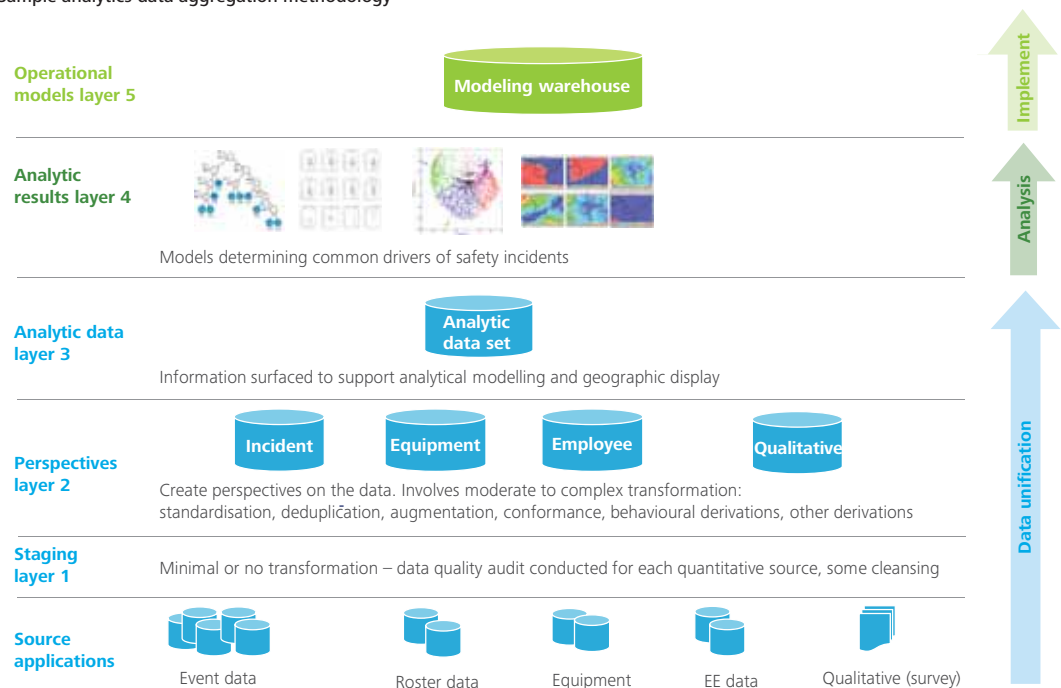
The primary challenge associated with leveraging all available data is that much of it is dispersed among enterprise resource planning (ERP) systems, case management systems, legacy purpose-built safety applications and various other secondary sources, such as equipment maintenance management systems and employee rostering schedules.

Additionally, much of the data companies require can only be found from external sources, such as weather reports, geospatial, socio-demographic and other sources of open data. These data sources are stored in different formats, in different system environments, and are subject to different data refresh schedules, making it very difficult to gain an ongoing holistic view of workplace safety.

With our Smart safety offering, however, organizations can begin to source and optimize a wide variety of data sources and fuse them into a succinct data set for simultaneous analysis of all factors potentially contributing to workplace incidents.

Approached effectively, this lets companies view raw data from distinct analytic perspectives (employee, crew, equipment, site, etc.) by collating the following internal and external data sources:

Sample analytics data aggregation methodology



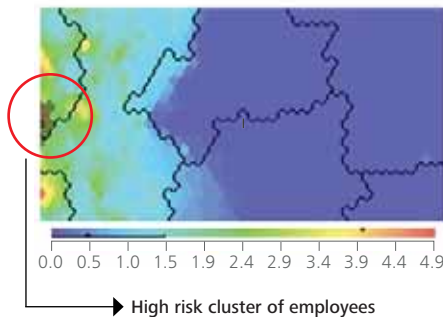
Make sense of the data

A predictive approach

The critical aspect of a safety analytics initiative is the ability to act on findings in a timely manner. This is where predictive modeling, advanced machine learning and data visualization technologies come into play.

Predictive modeling involves the application of data mining, statistical techniques to produce a mathematical model that can effectively predict and segment future events. Methods like the Smart safety approach leverage these techniques to holistically analyze disparate data and identify entities where certain conditions, indicative of high severity incident risk, are evident.

Segmentation of mining company employees



Here's how this type of process works in action:

Challenge

A large international mining organization which invested heavily in requisite safety processes, systems, structures, control systems and supporting culture was still experiencing an unacceptable level of severe incidents, injuries and fatalities. Driven by a recent fatality, the company decided to conduct a fact-based assessment of its current performance to identify key relationships between safety events that may point to incident root causes.

Solution

After collecting 620 independent data points and metrics about employee incidents from a mine site, we developed a detailed segmentation model (shown adjacent) that identified the variables that correlated with a high number of events.

Representative finding

This analysis found that individuals involved in mine site safety incidents were:

Significantly more likely to:

- Live on or near the job site
- Be involved in operating equipment at the time of the accident (83% of the events)
- Be half a day or less into their shift
- Have taken high historical amounts of leave
- Be highly tenured
- Have high levels of movements between zones on the mine site
- Be contractors

Significantly less likely to:

- Have partaken in key safety certifications
- Be a part of the maintenance job group
- Be identified as top talent

Results

The results challenged many of management's views on the drivers of accidents and also confirmed that preventive actions taken, such as training, were proving effective in mitigating the risk of incidents. After further reviewing, analyzing and combining these results with relevant contextual and situational information, the company decided to implement a roadmap that would help it monitor the effectiveness of its preventative actions and re-shape them as required.

Make Smart safety a reality

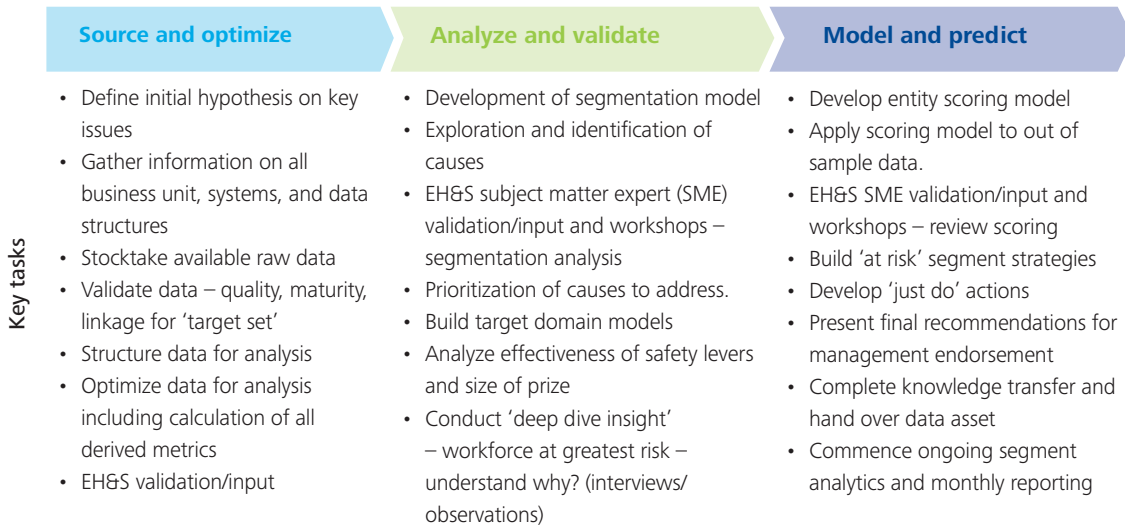
While it can take time to implement new processes, making Smart safety a reality can generally be accomplished in three steps: data acquisition and assessment, the identification of risk segments and the development of a predictive model and scoring system.

Notably, the cost of data analytics has also dropped considerably in recent years, making methods like the Smart safety approach more cost effective, and strengthening the business case for larger-scale Smart safety initiatives.

By effectively implementing advanced data analytic strategies, companies can do more than realize clear financial benefits through increased productivity, reduced litigation and sanctions, and the ability to focus limited dollars on the most effective interventions. More critically, organizations can reduce the human cost of safety by cutting the number and severity of workplace incidents.



Smart safety analytics approach



Is your industry at risk?

Effective safety risk management is important to all sectors to varying degrees. However, industries with inherently higher workplace hazards place a higher emphasis on safety controls and prevention.¹⁸

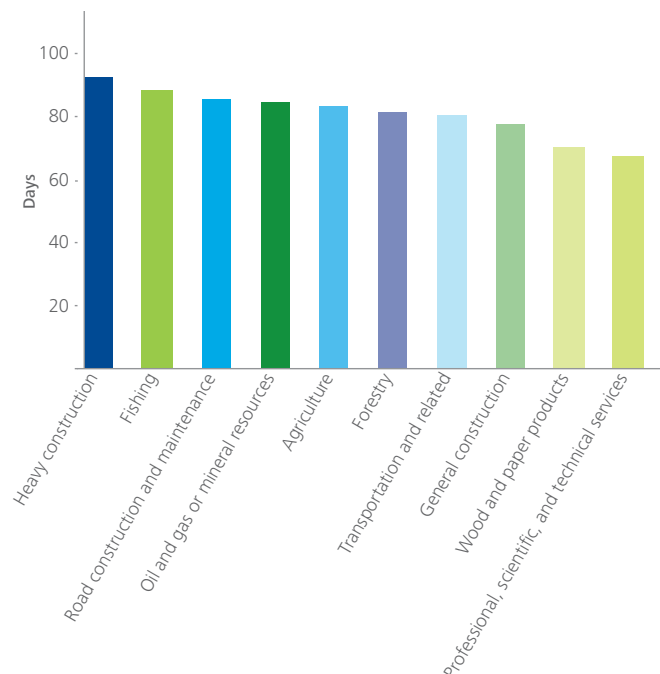
The degree of perceived risk influences the amount of attention and rigour dedicated to the design of safety programs and also dictates how closely those programs are linked with corporate culture and values.

Certain industries stand to benefit the most from continued enhancement of safety programs supported by analytics, according to the Association of Workers' Compensation Boards (see chart).

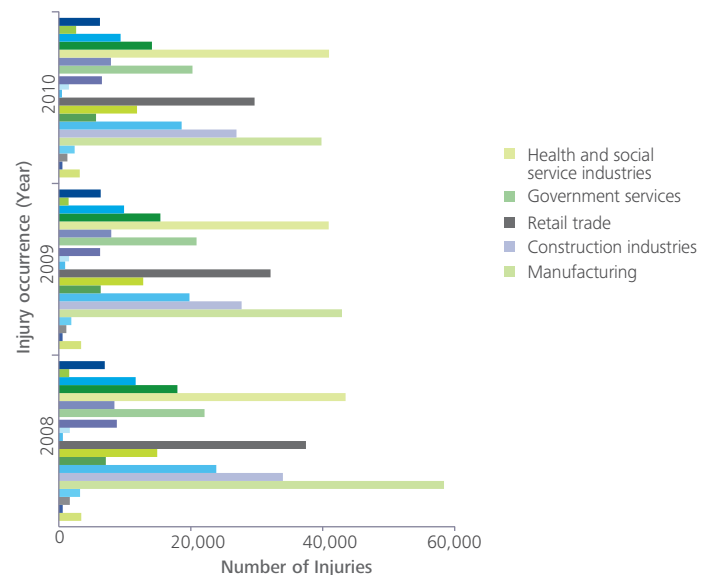
While these statistics show which industries suffer the highest frequency of lost time injuries, other industries with lower lost time incident counts can also benefit from a review of their workplace safety programs.¹⁹

According to a workers' compensation board, sectors with the highest duration of lost time incidents in 2010 included construction, forestry, agriculture, fishing and extractives, which all exhibited close to three-month average injury times. This represents significant direct benefit and lost productivity costs to participants in these industries.

Average claim duration by sector (2010), British Columbia



Number of accepted time-loss injuries by industry (2008-2010)



Get started

Organizations interested in applying analytics to inform their decision making around safety can take the following immediate next steps:

Understand and expand data collection

- **Inventory** current data collection and identify additional sources that can contribute to a holistic understanding of safety incidents. This can include machine telemetry, process data, HR and training, environmental, geospatial, socio-demographic and even data from other industry participants
- **Evaluate** and expand data collection relevant to safety – organizations need to collect holistic accident data – including employee, process KPIs, machine and equipment telemetry, weather, geospatial, shiftwork, performance reviews and time of week – to get a complete view of workplace safety incidents
- **Expand** the view of safety beyond the employee – safety interventions have been historically employee-focused. Data can empower safety strategies with a broader focus on machinery, process and the general working environment

Set up the organization

- **Develop** a business case that clearly quantifies the benefit to the organization of reducing the occurrence of workplace safety incidents and justifies the expenditure on data analytics capacity
- **Secure** executive sponsorship to ensure organizational traction for the safety analytics initiative. The ramp up and iterative model process takes some time. The executive needs to engage and secure the support of key stakeholders who will ultimately implement recommendations stemming from the model(s)
- **Confirm** financial metrics. What are the compensation costs, productivity impacts, etc.? Determine where best to focus efforts for maximum return on safety program investment
- **Enhance** internal analytic capability or partner. Consider building an internal capability or enlisting skilled partners. Organizations can equally consider new business models, such as crowdsourcing, to combine and analyze complex data efficiently and effectively
- **Engage** all stakeholders. Holistic data analysis resulting in a multi-channel safety strategy will bring different parts of the organization together

Play it safe

Regardless of the degree of workplace safety risk they face, most organizations have an opportunity to apply Smart safety analytics to improve the likelihood of success for their next safety intervention strategy.

Whether companies need to prevent a potential fatality at a mine site or reduce the frequency, severity and duration of lower back injuries in healthcare, harnessing the power of a broad range of available data can help enhance overall business efficiency, improve safety outcomes and lower costs related to workplace safety initiatives.



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