Preventing workplace injuries has been a goal of safety and business professionals for some time now. Nearly a century ago, occupational injury prevention was mainly done by protecting workers through various forms of PPE. Over time, injury prevention evolved to a more proactive state through the use of detection devices that could alert workers to hazards so that safety incidents could be avoided. Both of these practices are effective and key components of occupational injury prevention programs today.

However, many people believe these two strategies are not sufficient and will not get us to a zero injury state. Simply put, we are still experiencing significant levels of workplace injury and fatality rates. Many of these same folks who believe in the limitations of PPE and detection-based strategies are turning to advanced analytics to predict and prevent workplace injuries. There is clear evidence to suggest it can help us break through to a new level of injury reduction.

**Actual Results Using Advanced and Predictive Analytics**

Research has shown that if companies can predict injuries, they can be prevented. Figure 1 shows just one of many actual companies that were able to reduce their injury rates (in red) by using advanced and predictive analytics against an ever-growing safety data set (in blue). There are generally two ways to predict workplace injuries once a company has collected sufficient levels of workplace safety data. Let’s call the first way “self serve.” In this instance, a safety professional can use various levels of analytics to analyze the data and come to conclusions about what the analysis is saying about his or her work sites. Basic analytics, such as those available in Microsoft Excel or Access, allow for simple reporting and querying of the data. More powerful software systems, such as many safety management systems, can provide a more advanced level of analytics that often lead to deeper conclusions and better predictions. The best of these systems employ functionality that allows for automated alerts, statistical analysis, and forecasting and extrapolation.

The second way to predict workplace injuries is to rely on predictive models, which in rare instances are available in safety management systems. A research group from Carnegie Mellon University — the same team that helped build the Watson and Deep Blue supercomputers — studied four years of actual workplace safety data. They built models that can predict the number of injuries a work site will have with 80-97 percent accuracy rates.

Predictive models can proactively predict where and when workplace injuries will occur — in place of, or as a “second opinion” or confirmation to, the aforementioned “self-serve” prediction activities. In a book called *Competing on Analytics*, Thomas Davenport and Jeanne Harris describe the increased intelligence and competitive advantage that companies can achieve by moving beyond basic analytics and into advanced and predictive analytics. This is shown in Figure 2, which is an adaptation of a graphic from this book. As shown near the top of the graphic and in the actual customer results in Figure 1, if injuries can be predicted, they can be prevented.

**Case Studies**

Still skeptical about prediction? Here are three real-life examples.

In one instance, the vice president of safety for a large electrical contractor and system integrator logged into his safety management system on a Friday afternoon. The system’s advanced and predictive analytics functionality identified one of the contractor’s many projects as having an increased likelihood of experiencing an injury. He called the local safety manager, and they collaborated on the findings. They then decided that corrective and preventative measures needed to be executed. The safety management system identified the high-risk activities associated with that specific jobsite, such that on Monday, the contractor was able to conduct a safety “stand-down” where the high-risk activities were reviewed, as were the ways to manage those risks through hazard management procedures. Usually, this is where the story ends. No injury occurs, every employee goes home safe, and the skeptics can say, “You can’t prove that you predicted an injury because it never occurred.” Unfortunately, the story does not end here. Though there was no incident on that Monday, that work site did have an injury later that week. The good news in this story is that prediction in safety works. The bad news is someone still got hurt.

The financial impacts of safety prediction are immense. The aforementioned contractor, in spite of...
Data Requirements

Only observation data are required for the model to work. The ability to have a model that only relies on safety inspection/observation data and requires no injury data was deliberate and critical for three main reasons.

First, using incident data is expensive. OSHA estimates the direct cost of a recordable incident is $7,000 and a workplace fatality is $910,000. Other industry experts put the indirect costs at three times those amounts. Can companies really afford to rely on such costly occurrences just to get access to data that can help reduce their risk in the future?

Second, waiting for incidents to occur before preventing new ones sends a very chilling message to employees about the company’s safety culture. To put it bluntly, the company is essentially saying, “John, I am going to wait until your arm gets severed in our production line before I figure out how to ensure Carol doesn’t suffer the same fate. In the meantime, stay safe, and keep that production line moving. We have profit goals to hit!” If leaders are trying to drive both a strong safety culture and productivity, this is not an acceptable option.

Finally, companies simply run out of incident data points to analyze and learn from. If a company succeeds in driving its incidents down to just a few or even zero, is it truly safe? How does it know its rates will stay low? The devastating incident with the Deepwater Horizon oil rig where 11 workers lost their lives on the very day of the blast on the rig, executives were aboard it knew its rates will stay low? The devastating incident with the Deepwater Horizon oil rig where 11 workers lost their lives. In the meantime, stay safe, and keep that production line moving. We have profit goals to hit!” If leaders are trying to drive both a strong safety culture and productivity, this is not an acceptable option.

Why is this happening?

What actions are needed?

Where exactly is the problem?

How many, how often, where?

What happened?

Figure 2. Prevention relies on advanced and predictive analysis.

Griffin Schultz is general manager of Predictive Solutions, a wholly owned subsidiary of Industrial Scientific Corporation. He can be reached at gschultz@predictivesolutions.com or 412-490-1996.

Figure 1. More data allows for more analytics, which reduces incident rates.

In another example, a subsidiary of a Fortune 200 manufacturing company was able to reduce its incident rate by 76 percent utilizing advanced and predictive analytics resident in its safety management system. A division of a Fortune 150 energy company was able to reduce its incident rate by 67 percent in one year. Evolving to an injury prevention program that includes advanced and predictive analytics, after focusing solely on PPE and detection, was a game changer for these companies.

Analytics Can’t Replace People

As powerful as they are, safety management systems that employ advanced and predictive analytics still can’t replace people. Generally, as described above, they should serve as a “second opinion” or corroborating source of information to safety professionals. Even before the existence of safety management systems, safety managers were making intuitive predictions on where to allocate their resources to best prevent injuries. They can still do that, either in an intuitive or through the previously described “self-serve” capabilities in safety management systems, but now they can check those predictions and hypotheses against these highly accurate predictive models.

A safety professional’s knowledge is constrained by the experiences he or she has encountered, read about, or heard about, wherever a computer model is constrained only by the experiences (in the form of workplace safety data) we feed it. Through computer-based models, we can extend the knowledge of safety professionals.

Regardless, even if computers could replace safety managers in the prediction of injuries, it still takes people to execute the corrective and preventive activities effectively to prevent that predicted injury from occurring. We, unfortunately, learned this in the example of the electrical contractor previously mentioned.