Session No. 537

"What are the Odds" – The Probability of an Accident

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Introduction

Most of us believe that we have a clear understanding of the definition of risk. But risk has many definitions. According to Merriam-Webster's on-line definition, risk is:

- possibility of loss or injury
- someone or something that creates or suggests a hazard
- the chance of loss or the perils to the subject matter of an insurance contract; also the degree of probability of such loss, a person or thing that is a specified hazard to an insurer, or an insurance hazard from a specified cause or source
- the chance that an investment will lose value

The last two definitions reflect risk transfer through the insurance contract and risk and return model for an investment strategy. The first two are most important to the safety professional. They relate to the potential for injury and the probability of an accident.

Since an accident is an unplanned or unintentional event, we need to assess the likelihood of it occurring. Once we understand this, we can address each potential adverse outcome with appropriate resources. We certainly will not invest as much to the prevention of a paper cut as we would to the prevention of an amputation. Yet if the probability and expected frequency of a paper cut is very high and the environment is not clean, there is a greater potential for a staph infection, which in some cases has proven fatal. According to the *The Telegraph* 12-23-2008, "Man killed by flesh-eating disease after getting small cut on arm". (1) One person might rush to cleanse and bandage the wound and another might ignore it. The individual behavior certainly affects the outcome.

We need to not only understand the probability of an accident but the risk appetite or tolerance of the individual, the culture of risk of the organization and the risk awareness as defined by Dr. Dylan Evans, from the London School of Economics, in his book, the person's Risk Intelligence. (2) For example, on a given Saturday afternoon, there are soccer games at two fields in town. Clouds move in and there are sounds of thunder. Although no lightning is visible, one coach or referee calls the game while another has the teams keep playing. What risks are they taking? When, if at all, should the game be called off? Does the soccer organization provide direction or monitoring? When is risk tolerance too low or too high? Should we gamble if the rewards are high?

In the above example, one could argue that the coach or referee that allows the teams to keep playing is ignoring the safety of the children and putting them at risk of injury from a lightning strike. Last July, in Harris County Colorado, a lightning strike from a sudden storm killed two soccer club players. US Youth Soccer states "postpone activities promptly" in the event of thunder or signs of a potential storm approaching. Were the coach and referee properly trained? Are rules enforced? Maybe they thought the risk was minimal and assessed the likelihood of injury as negligible.

According to the National Weather Service, the odds of being struck by lightning and killed or injured in a given year is about 1/1,000,000 based on reported cases. Obviously this increases in an open field under the right conditions.

Many of us use the lottery as a baseline for evaluating odds. Your odds of winning a "pick six" lottery, where the order of the numbers doesn't matter and there are 35 numbers to choose from, is 1/1,623,160. We may buy tickets but few of us expect to win. Could the coach, that keeps his team on the field, have too high a risk tolerance level? If the coach was losing the game would his perception be any different?

Where do we want to place risk takers as well as risk avoiders? We might want a risk taker as an athlete and need them on the bomb squad; but not as a doctor or aircraft mechanic. I would consider appointing a risk taker where the returns are high without a catastrophic downside. A balanced economic formula leads to a risk return ratio that is acceptable. If the risks go up, the return must also increase for a given situation. But what if there is no or minimal return? In general, violating safety procedures such as reaching too far from a ladder or not wearing safety glasses provide minimal if any return. We do not want employees taking those risks but some do.

According to Dr. Evans' studies, we have greater risk intelligence or awareness when we place a probability on the events and high risk intelligence when we can estimate the probabilities accurately. He defines the "most dangerous combination" is a person with high risk appetite and low risk intelligence. He provides a free on-line test to estimate risk intelligence at www.projectionpoint.com. The test also considers your confidence level. If you are highly confident that an answer is correct and it is wrong, you have lower risk intelligence.

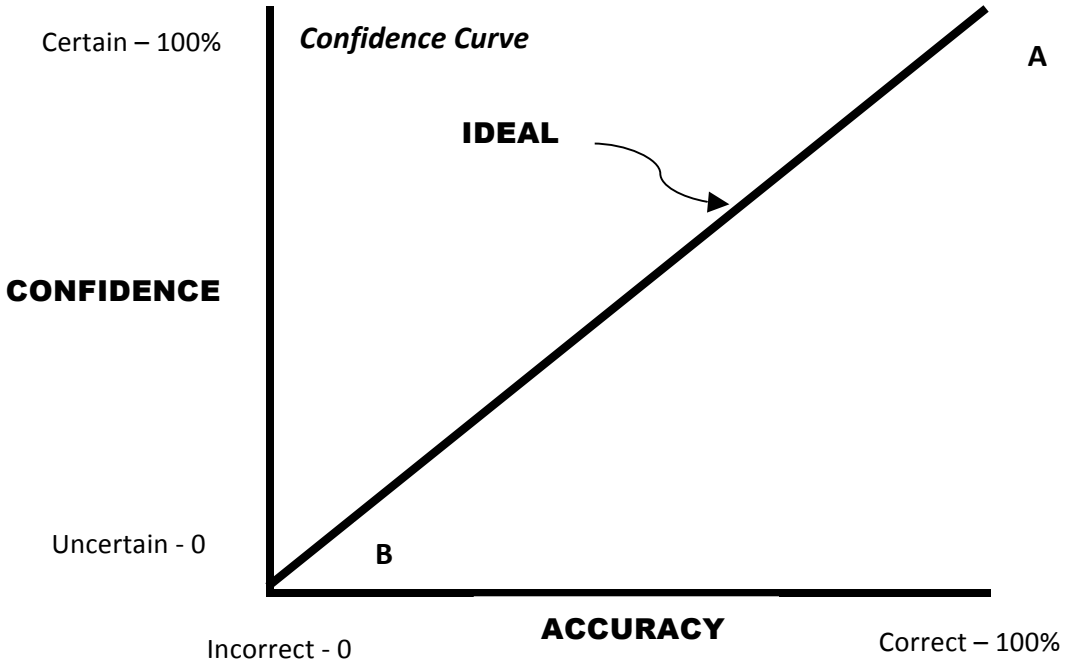
We cannot know everything but we can make guesses based on our general knowledge and/or experiences and how it relates to the question. The classic example supporting our ability to estimate the likelihood and level of confidence of an event is the Fermi problem. Enrico Fermi, a former professor at Columbia University and the University of Chicago, is best known for his work on the Manhattan project and for a Noble Prize award in physics. The problem he presented to students at the University of Chicago was to estimate the number of piano tuners in the city. They knew there were about 5,000,000 residents and estimate that there were 2 persons to a household and the 1 in 20 had a piano. They further estimated that the pianos were tuned once a year and that it took two hours to tune a single piano. Based on a piano tuner working 8 hours a day, five days a week and 50 weeks a year; there was high probability that there were 125 piano tuners in Chicago. A person following this logic would have a high confidence level on the results.

If we can estimate more accurately the chance of an injury, will we change our behavior? Why would a construction worker on a high rise building project wear his hard hat? The most common answer is safety or to avoid an injury. How many of the workers truly believe that they are safer and how many wear it to meet the rules to be on the site?

OSHA estimates that there are about 6,500,000 workers on construction sites on any given day. In 2004, they ranked lack of proper head protection fifth on the frequency list of issued violation notices. Also in July of 2011, the *American Journal of Preventive Medicine* reported that the construction industry had the greatest number of traumatic brain injuries in the United States. (3)

Given the potential of fallen object, bumps and electrical shock exposures; one with high risk intelligence could estimate the potential of injury without knowing the actual facts. High risk tolerance would not be a virtue for a worker at an active construction site.

There are many ways to have an effect on an individual's assessment of risk. One way is to erode their sense of confidence by establishing the perception that they can't avoid an accident unless practicing safe behavior. There is an ideal relationship between confidence and accuracy (see *Confidence Curve*). The ideal relationship exists when there is clear uncertainty and the behavior is inaccurate (location A) or when there is 100% certainty and the accuracy of a behavior is correct (location B).



In the example of the construction worker, he or she may be certain that they would not be injured when not wearing their hard hat if the job is paving a road with no overhead hazards. In this case, they may be 100% correct and the situation would be ideal. On the other hand, we need to influence behavior if they are certain that they will not be injured while working under a crew erecting a roof system.

What are ways that we can reduce the probability of an injury by controlling the confidence level in an environment that has safety hazards? If we cannot eliminate or control the exposure, we provide safety training and/or personal protective equipment. Both solutions require that the individual adjust their behavior. Therefore, they must have confidence in the safe practices and benefits of the equipment.

Training alone does not always produce the results necessary to ensure the safety of the individual. Repeated and consistent messages are more likely to influence behavior. This is well known by advertisers who promote well-known brands like Coca-Cola™ or Geico™ by repeating television commercials even though they have high market share and name recognition. The constant ringing of bells on slot machines when someone wins is to effect the behavior of potential gamblers who are more likely to imagine themselves as winners by the repeated reminder that winning is possible.

Another example is the reaction to the repeated showing of the airplane crashes on September 11 which resulted in more people driving their automobile when air travel is clearly safer. As reported in the *Wall Street Journal* on September 23, 2004, domestic air travel dropped almost 12-20% for the three months after 9-11 while travel by automobile increased. "Because of this extra traffic, 353 more people died in traffic accidents, calculates Gerd Gigerenzer of the Max Plank Institute for Human Development in Berlin, an expert on how people respond to low-probability but high-consequence events called "dead risk."" (4)

Albert Einstein once said, "The definition of insanity is doing the same thing over and over again and expecting different results". We want to re-enforce the message over and over again to get the results that we expect. This will reduce the probability of an accident by influencing risk appetite and developing risk awareness.

References

1) The Telegraph Media Group Limited UK - 6:05PM GMT 23 Dec 2008

2) Risk Intelligence by Dylan Evans – Copywrite 2012 Free Press, A Division of Simon & Schuster, Inc.

3) American Journal of Preventive Medicine – The Epidemiology of Fatal Occupational Traumatic Brain Injury in the U.S. – July 2011 (Vol.41 | No. 1 | Pages 61-67

4) Wall Street Journal by Sharon Begley, staff reporter – March 23, 2004