A Fearless Look at What Really Causes Accidental Injuries and Fatalities

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As the title indicates, you probably realize we must be talking about acute injuries, as it's very difficult to kill yourself from doing too many key strokes or mouse clicks per day. Or, if you think of the highway, where there are 10-20 times more accidental fatalities than in workplaces or factories – it's easy enough to hurt your back if you've got a bad car seat and you drive a lot, but it's unlikely that the bad car seat will ever kill you. So, if there was a question as to whether we're talking about acute injuries or repetitive strain injuries, the answer is easy.

We're talking about acute injuries. However, the important question, "What really causes acute injuries?" isn't so easy to answer. What if the answer is much different than what we've been taught? And finally, how do you know – or how do you prove – that it is reality? A fairly tall order, to be sure.

Let's start with what you knew before you ever started working or working in the EH&S profession. You knew how you had been hurt. And you knew when and how often – although you might not remember much below age 6 or 7. Then, you learned about occupational health and safety including the legal aspects and compliance issues. Probably the importance of management "commitment" was stressed. Then we learned about unsafe acts, unsafe conditions, risk pyramids and multiple factor accident causation models. Question: "How many unsafe acts does it take to cause a fatality?" Answer: a. 30,000 b. 300,000 c. just one.

And when we learned about all of this (in my case, 20 years ago), did we hear about how an employee's "attitude" causes these deliberate unsafe acts? And how these unsafe acts caused over 90% of the workplace injuries? Unfortunately, a lot of us did hear this, and we heard it over and over. And we heard it from lots of people (although very few people around today ever heard it from Heinrich himself). (See Figure #1.)
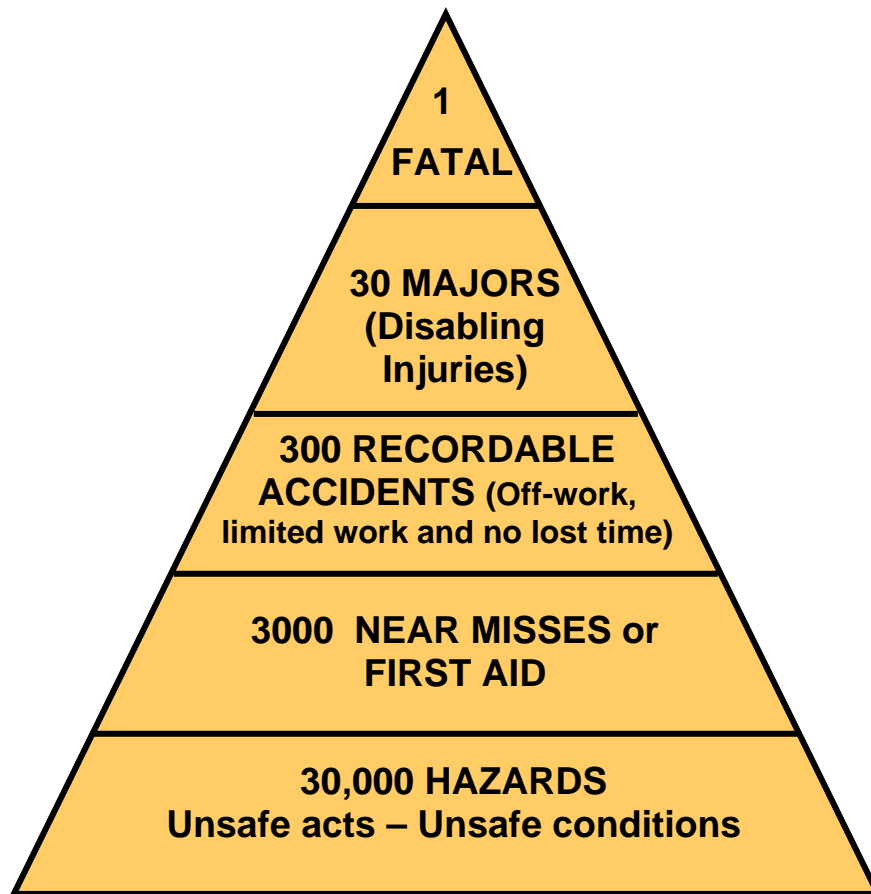
Figure #1. Risk Pyramid

Now, one of the problems with hearing things over and over – from lots of different "experts" is that pretty soon some people stop questioning what they're hearing. Even if what they're hearing is different from what they know for sure: how and when they got hurt. Which is understandable (or forgivable) because while we may know exactly, for sure, definitely, etc. how and when we've been hurt – we know that our own personal injuries are only a small number compared to the millions and millions of injuries that occur every day around the world (if you count all of the cuts, bruises, bumps and scrapes). And just because we know for sure, exactly, definitely, etc. what got us hurt, that doesn't mean that's how everybody else got hurt. Personally, I thought everyone else got hurt like the models said, but that my injuries – for whatever reason – just didn't fit. But that was "acceptable" too, because I really didn't "work" for a living – I just "talked". Granted, I had to fly a lot and drive a lot, but somehow I thought that was "different" because I wasn't doing the type of work that the models were based on… In other words, I had no problem accepting that I was an "exception to the rule" because I did "different" work…

Until the day I nearly killed myself falling asleep while driving back from a generating station in the middle of nowhere. Model or no model, different or not – dead is dead. And I *had* to accept that. Human error could kill. I had just proven it. And yet I had never heard anyone in

occupational health and safety talk about human error. All I had heard about was unsafe acts, unsafe conditions and attitude. But all that was about to change because in the '90s, attitude wasn't the problem any more. It was behavior. Behavior became omnipotent and attitude wasn't so important any more. At-risk behavior had replaced unsafe acts and attitude - but in name only. Hardly anyone talked about the three different types of at-risk behavior. Most people were still referring to deliberate conscious decisions workers made to increase risk or conversely, not to decrease risk. They weren't talking about the other two: habitual at-risk behavior (automatic) and unintentional at-risk behavior (error). How important are these two types of at-risk behavior? How often are they involved in acute injury causation?

   Before we can answer these questions, we need to look at the basic components or factors that need to be involved for an accidental injury to occur:

1. There has to be at least one source or form of potentially hazardous energy.
2. There has to be a person (you can have an incident but without a person involved, you can't have an injury).
3. Something unexpected or unplanned has to happen. (If there was a deliberate attempt to injure someone, it wasn't an accidental injury.)

   Ok, so how many unexpected things do you think have happened to you already this lifetime, thousands or millions? Well, even though millions of unexpected things have happened to most of us, if you think about it, there are really only three sources of unexpected events (see Figure #2). Either you do something unexpectedly, the other guy does something unexpectedly, or the equipment does something unexpectedly. It will be one of those three – or a combination of them. Unless, of course, it's an act of God.

Figure #2. Sources of Unexpected

    Ok, so which of those three areas is the largest, or will be involved in the highest number of incidents and injuries? Well, after thinking about it for a while, most people will "freely" admit that the Self-area will probably be the largest. But until you get them to think about what they know for sure, definitely, exactly, etc. which is how they have been hurt – both on and off the job – they will probably have a hard time estimating it to be as high as it really is.
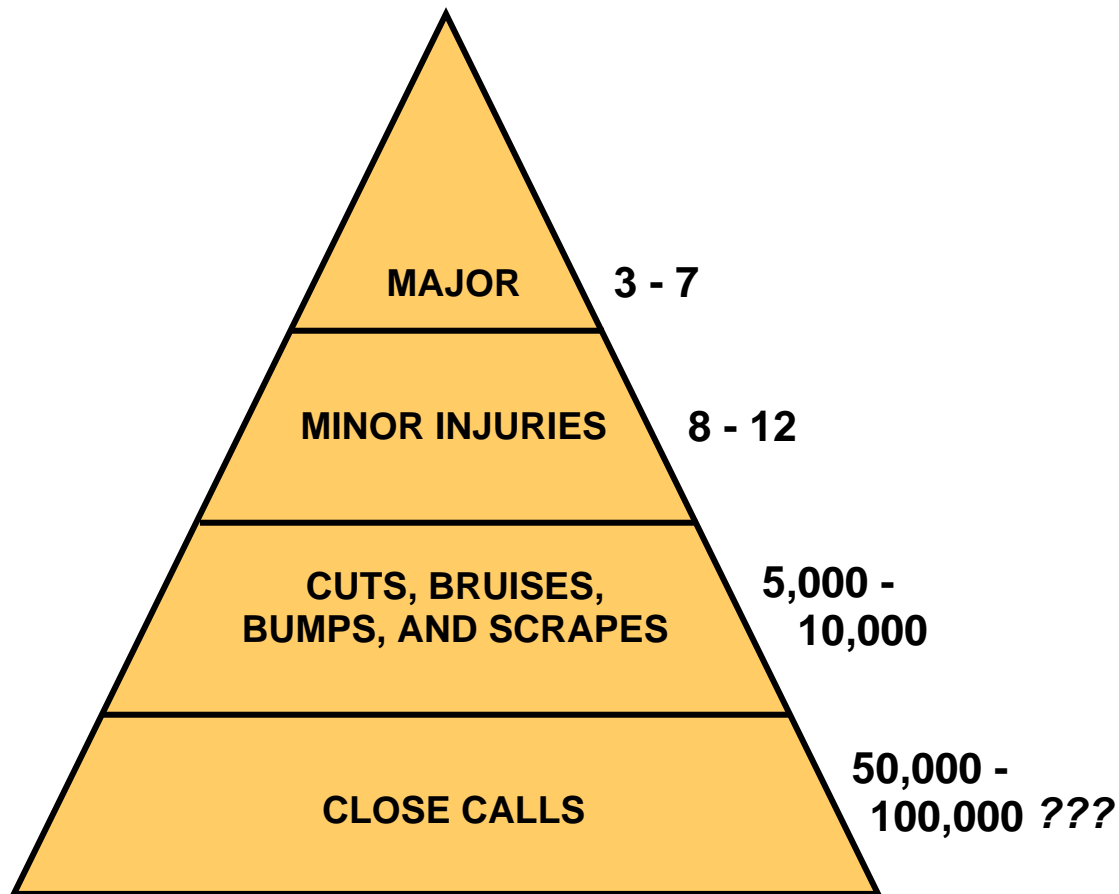
Figure #3. Personal Risk Pyramid – Self Area

Person Risk Pyramid
If you ask people to build their own personal risk pyramid, it really helps to (might be one of the very best ways) get them thinking about all of the times they've been hurt.

   Start off by asking how many serious injures they've had (broken bones, torn ligaments, concussions, 3rd degree burns, etc.). The average will probably be somewhere between three and seven if you've got 100 people in the room. Then ask them how many minor injuries they've had (stitches, sprains, significant muscle strains, etc.). The average will probably be somewhere between 8 and 12 if there are 100 people in the room. Now ask them how many cuts, bruises, bumps, scrapes, burns and slivers they've had. NOTE: There will likely be a large groan at this point. But some people will say hundreds and others – who might have remembered to think about the first ten years of their lives when they got hurt 15-25 times a week – who will say thousands.

   So most adults have probably had 5,000 – 10,000 cuts, bruises, bumps and scrapes with over 90% happening before they were 16. Ok, and for the last level, asking people to even guess at how many close calls or near misses they've had isn't going to provide very reliable information. (For instance, how many times have you lost your balance this lifetime?) But everybody can

remember most – if not all of their potentially fatal close calls. If you ask them whether they've had 10-15, 15-20 or 20 plus, 60-80% of the people will probably put up their hands for 20 plus. Especially if they thought about all of the times they've fallen – or almost fallen asleep at the wheel. Now that they've had a bit of time to reflect on what has actually happened to them, ask them to think back to the three sources of unexpected events. Ask, "How many of you have been seriously hurt because a piece of equipment you were working with broke or malfunctioned unexpectedly?" NOTE: if there are 100 people in the room, you will probably get two or maybe three hands in the air.

Now ask them about the other guy doing something unexpectedly (not including contact sports). NOTE: you will probably get 10-15 hands in the air. Now ask the people who just had their hands up if any of them have more than one example of getting seriously hurt because the "other guy" did something unexpectedly. NOTE: you might get one or two hands in the air for this one.

So, for serious injuries, well over 90%, the unexpected event that initiates the chain reaction that got them hurt wasn't the equipment or the other guy. It was us. Now here's where it gets really humbling. If you move down the risk pyramid to include all of the cuts, bruises, bumps and scrapes, then for most of us over 99% were initiated in the "Self-area". NOTE: this exercise has been done with over 100,000 people (mostly in North America).

So, it would appear that the "Self-area" is by far the highest area of concern. Now, if we just think about these types of injuries - for the most part - they're not very complicated (stubbing your toe, banging you shin, cutting your hand, etc.)

All you need is a source of potentially hazardous energy and then – unexpectedly – that hazardous energy has to come into contact with someone, or they have to come into contact with it. Now if it hits them, you could say they were in the path of the hazardous energy or in the line-of-fire, and if they hit it – well, it's unlikely they'd do that if they were looking at it or thinking about it, unless they'd slipped, tripped or skidded into it inadvertently (loss of balance, traction or grip).

Now, ask the group if they've had any injuries that were initiated in the "Self-area" – when these four errors weren't involved or weren't a contributing factor. If you exclude contact sports, you won't get one hand in the air!

Four errors: eyes not on task, mind not on task, moving into or being in the line-of-fire or somehow losing your balance, traction or grip are involved in over 99% of the accidental acute injuries – on and off the job. That's a fair bit different than what a lot of us were taught. Nevertheless, we're only interested in reality, as it's reality that causes accidental injuries and fatalities.

Accept that the hands in the air aren't lying; then human error is involved in 99% of all accidental acute injuries and fatalities. (Making an error of any kind is always unexpected.)

So what causes human error? That's easy – ask anyone: rushing, frustration, fatigue, complacency, extreme joy, extreme sorrow, panic, etc. All of these states cause human error.

But the four states that cause the most problems – on a daily basis – are rushing, frustration, fatigue and complacency. After all, it's not Christmas every day, you're not going to a funeral every day, and with any luck at all, you're not running out of a burning building every day…

So, now ask the group if they can think of a time they've been hurt – where the unexpected event was initiated in the "Self-area" – when they weren't rushing, they weren't frustrated, they weren't overly tired and they hadn't become so complacent with the hazards in their surroundings that they just weren't thinking about them at the moment they got hurt (not including contact sports). Chances are, if you've got 100 people in the room, you won't have a hand in the air. So it seems that for almost everybody that these four states: rushing, frustration, fatigue and complacency, caused or contributed to four critical errors: eyes not on task, mind not on task, moving into (or being in) the line-of-fire, or a loss of balance, traction or grip. This state to error pattern (see Figure #4) was involved in every accidental acute injury they've had where the unexpected event was initiated in the "Self-area" – which is over 99% of their total accidental acute injuries. Or, to put it another way, one or more of those four states lead to one or more of these four errors, which increased the risk of whatever activity or task the person was doing.

Figure #4. State to Error Risk Pattern

What To Do About It

Simply making people aware of this state to error pattern might be somewhat helpful, but if you want to really help them, you'll need to do more than that. If you look at the pattern, the state comes before the error. That means we could use the state as a trigger to think about not making a critical error. However, that technique won't work very well for complacency as it's much easier to tell that you're in a rush, or you're tired or frustrated. So, for complacency leading to mind not on task – and mind not on task leading to other critical errors – we'll need to look at what people are doing automatically or habitually, since they aren't thinking about what they're doing. In other words, we'll have to tell them what habits to improve (e.g. move eyes before hands, feet, body or car), so that what they do automatically – or habitually – is safer.

Getting people to improve what they do automatically will definitely help to compensate for complacency leading to mind not on task. But it's always better if you're thinking about what

you're doing, because your habits and reflexes – alone – don't give you the ability to anticipate a dangerous situation that's about to occur so you can get yourself completely out of the line-of-fire. You need your mind for that so we also need a way to help people get their mind back on task from wherever it may have drifted off to. However, if they start looking for these state to error patterns (and once you start to see them, you see them everywhere), then every time they do see one, it will almost automatically make them think about what they're doing at the moment.

The last technique we need to teach them is to analyze their close calls and small errors to determine if it was a state like rushing, frustration or fatigue that they didn't "self-trigger" on, or if it was complacency leading to mind not on task, then it's probably a habit that still needs more work. Now, teaching these techniques to people is one thing. Getting them to put some effort into improving is another. In other words, they don't just need information – they need training. But if you're willing to invest the time, effort, etc. to train them well, the injury reductions – both on and off the job will be more than worth it. Moreover, since these concepts are simple enough, with a few training aids, employees can also teach these concepts to their families, which helps the employee learn it even better. If your company also pays for all of the employee's dependants' injuries, then the return of investment for this kind of training is huge. In some cases, it's been over 1000% in three years. However, if you deal with reality, you will prevent injuries – lots of injuries – on and off the job.