Stanford eCorner

Dynamic Model of Accidents

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The patient risk in anesthesia highlights the dynamics of accidents. The problem: How can the management of anesthesia systems be improved to decrease patient risks that could occur in the operating room environment? To compute the probability of an accident of all scenarios, a dynamic model helps to understand how fast things could go wrong once an accident first occurred and how fast someone must react to resolve the problem. Among the contributing factors causing an accident (work schedule, training, and experience), Dr. Elisabeth Paté-Cornell, department chair of Management Science and Engineering at Stanford University, says that simulated training helped decrease accidents by an optimistic 16 percent.

Transcript

Second case, the patient risks in anesthesia. Now, again for something entirely different. This is a classic case of dynamics of accidents. So the question was how can we improve the management of anesthesia system to decrease the patient risk? So what we did is to look at the accident sequences that could occur in the operating room environment. And so first, we look, generally, at how accidents unfold, how the competence and the alertness of the anesthesiologist influences the factors of risk, and how the management could influence the competence and alertness of these guys? And I'm going to show you what we found. So we did a classic model, and there is only one equation in all my talk. I'm only to show you that to compute the probability of an accident over all the scenarios, we sum over all the probabilities of the initiating events. These events that start an accident sequence. For example, a tube disconnect, since the patient needs to receive oxygen in the lungs multiplied by the probability of an accident once this incident has occurred. And that's where we had to do dynamic model.

And by the way, this is really one of the problems that you have in general. Once things go bad, how fast is it going to go bad? So that, you can ask yourself how much time you have to react. Their sources here were really interesting, because we had statistics at both ends of the model and expert opinions at the middle, so that we were confident, pretty confident, in our results. Now, the way we look in general, as I said, at the effect of human and management factors on risk in our analysis, we start by the filaments on the events. We look at the way human performance affect these filaments and we look at the way management policies that affect human performance. And as I said, these are generally incentives and resources. So what kind of management measures did we find that affect anesthetists' performance? Exactly what happens everywhere. I think this is - it could happen in the airlines, it could be pilots instead, work schedule, selection predicting, experience, supervision of the residents which turned out to be a critical problem, and of course, maintenance of the equipment. Now, for example, we look at simulator training. And we said, "Well, by how much could we decrease the risk if we were asking people that were on the simulator, let's say, every year?" And we asked many experts on the different parts of the crime, what difference would it make? Let me tell you, my best experts were the operating room nurses.

They have seen it all and they knew exactly how people are messing up. And they helped us identify the accident sequences, what it was that the simulator could teach these guys? And it's exactly the same problem as for pilots. They prefer that they encounter these problems on a simulator before they encounter them in life. So it was about the risk reduction of 16% that I think was pretty good. OK, and by the way, the British told me that this I was a bit optimistic, also perhaps I'm a bit optimistic but that's what my experts thought.