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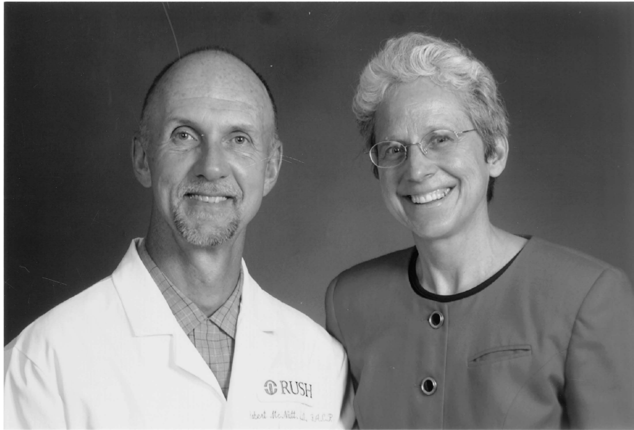
QMHC Interview

The Theory of Constraints and Medical Error: A Conversation With Robert A. McNutt



The Patient Safety Committee of Rush University Medical Center uses the Theory of Constraints in its review of adverse events. In this interview, Dr Robert A. McNutt, Associate Director of Medical Informatics, discusses how it provides a conceptual framework for identifying core causes of error as well as offers a model for planning safety improvements. In earlier interviews with Ms Odwazny, published in this journal,[1,2] he has discussed Rush's work in the areas of quality management, patient safety, and error prevention.

MCO: Reducing medical error is a pivotal contemporary patient care issue, and we've spoken in previous articles in this journal about the breakthrough work your Patient Safety Committee has been doing in this area. Let's take the discussion one step further and explore how you and your group locate and identify error. What kind of roadmap does your committee use?

RMcN: Our safety committee uses individual cases as our source of data about safety. We spend almost no time looking at trends or frequencies of adverse events, because the adverse events themselves do not tell us why they occurred. Individual rather than aggregated cases help us better understand the cause and effect relationship between clinical decisions and/or processes of care and adverse events. Also, there are so many adverse events

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reported each month that it would be impossible to examine each case. Luckily, of the nearly 400 adverse events reported per month by our providers through our online reporting system, only about 20 are serious enough to be evaluated for unsafe care.

When we evaluate cases, we conduct an independent review, which means that people not involved with the care make judgments about mistakes and errors. We find that this independent review results in a more comprehensive assessment and different judgments about cause and effect than we would get if the actual care team did its own evaluation. We work hard to remove blame, shame, and defensiveness to help us find the true causes of adverse events so that we can avoid them in the future.

MCO: What do you look for in your assessment?

RMcN: First of all, we know that many adverse events actually are not errors. For example, complications can result from a high-risk procedure, even if the procedure is carried out correctly. The explanation can simply be randomness, which is not preventable, or it can reflect a systematic cause, which might make it preventable. We search for those decisions or processes of care that increase the probabilities of adverse events. But distinguishing between random and systematic causes of adverse events is a challenge. At this point, medical care does not have reliable or standard ways to directly observe errors that lead to adverse events.

Given the lack of standards, we have developed a routine, step-by-step process to assess the cases. First, we create a timeline that starts with the first discernable clinical decision and ends with the adverse event. This "time stamped" list includes all decisions and processes involved in the patient's care. In other words, we develop a chain of events leading to an adverse event, and we do it using chart review and interviews with patients and providers. This means that we only review current cases, because interviews with providers are essential to understand the potential barriers to safe care. Chart review alone is never enough. After establishing the chain of steps, we then review each individual step, decision, or process of care. We may find, for example, that the decisions were solid, but the care was not delivered appropriately. If this is true, we then develop a second chain of events for that process of care. Alternatively, we may find that the care was delivered appropriately, but the decision may have been faulty.

One principle we use in our assessments is to look for the single step in the chain that is most likely responsible for the cascade of events leading to the unsafe care. We do this for the following reasons: First, there are often multiple weak steps in the chain of events leading to an adverse event. We do not have the time to fix everything, and so we want to fix the step most likely responsible for adverse events. Second, and more important, we find that most causes of adverse events are not complicated. In fact, we usually find a single core cause that drives a system to make a mistake.

This philosophy and our empiric evidence about mistakes and adverse events are out of step with current theories about error. One of these, the "Swiss Cheese" model, assumes that adverse events occur when the weak steps in the multilayered systems of care align. If correct, to be safer we would have to fix the weak steps in each component system.

We find a very different situation. We find that usually a single idea—policy, plan, or process—when not well thought out, drives the entire system and increases the likelihood that an adverse event will occur.

MCO: It's interesting that you look for a single component that is pivotal to the outcome.

RMcN: We follow a model of system improvement called the *Theory of Constraints* (TOC). Before using TOC, we often tried to fix the undesirable consequences of care rather than the core causes. For example, we evaluated a case in which poor communication and lack of transfer of useful patient information were cited as the cause of the patient's adverse event. If this were true, the fix would be to improve communication. However, we looked deeper to find the reasons or core causes of the poor communication, and we found several. The real issue was not poor communication; the issue for this specific case was a system of care that required the transfer of information at that juncture in the first place.

This sketchy example illustrates that TOC forces us to think in terms of finding a single cause that fans out to cause multiple mistakes, which, in turn, fan out to increase the likelihood of adverse events. The theory attracted us empirically—it fit what we were seeing—and helped us focus our improvement efforts at core causes.

TOC was first applied, I think, to manufacturing and project management. It involves a set of principles and tools that can be used to find the core causes of adverse events. The theory tells us that adverse events result from deeper causes (errors), and suggests that unsafe care, for each specific case of an adverse event, is caused by one major constraint.

I've described how we review cases by developing a chain of events leading to an adverse event. Any step in that chain may increase the risk of the adverse event. However, TOC says that one step most often drives all the others; only one step is both necessary and sufficient to lead to the adverse event in each case.

MCO: How do you find the single step?

RMcN: Sometimes it is easy to observe the cause and effect link between the mistake and the adverse event. For example, if a medication order is illegible and the provider makes a mistake in dosage because of this, the linkage is clear. Much of the national safety work has focused on these sorts of mistakes, and rightly so. For these, we can see and touch the delivery system.

But most of the cases we evaluate are not so easy to classify, because they involve many delivery systems. Systems devised by doctors, nurses, pharmacists, information managers, administrators, and lawyers all intertwine to create a complex arena for mistakes. For these clinical situations, finding cause and effect when an adverse event occurs is hard work, not easily described. But I will try.

Each case we evaluate has multiple sets of decisions and procedures needed to deliver care. In addition to these concrete steps, there are often multiple complaints, finger-pointing experiences, and myriad hypotheses about why some bad thing happened to a patient. We use these to find the core decision or process causing the most complaints.

We try to link all the complaints and steps in care by asking questions like, "Why did this happen? What caused this to happen? What could be done to circumvent your complaints? What benefit did this decision give? What risk did this decision give?" We keep asking these sorts of questions for each step in the chain and for each complaint about care. We keep asking until we can no longer find any answers to our questions. At that time, we are likely at the core cause. TOC calls this building a "current reality tree." The tree of answers to these questions spirals toward a single core cause that answers all the questions.

Finding a core cause is largely a logical process, but it requires a facilitator to keep asking for reasons and links to why some decision was flawed or why some procedure failed. This task is often arduous, which is why we do it only for a few rather than many cases. At times, TOC leads us to some core cause that if fixed will circumvent multiple cases of adverse events. The results often justify the efforts.

We apply two additional criteria to decide that a medical decision is an error. First, we use evidence, including data from research literature, to determine whether the decision provided benefit in excess of harm. If it did not, we take note. We then apply a second criterion before classifying a decision as an error. We must be able to prove that something can be done to change the decision and that if the decision had been different, the adverse event would have been less likely to occur. This standard, which demands proof that some change in a decision or process of care leads to safer care, is a critical and often overlooked requirement in safety research. It is also a component of TOC. TOC first forces to logically link events in a chain until we see which step in the chain may lead to increases in adverse events. Then it forces us to redraw the steps to see if we can devise a better way. If we can't, then maybe there is no mistake.

MCO: Can you give us an example to clarify?

RMcN: This may help. We reviewed a case of a patient who died of a complication of a procedure performed to treat infection caused by a low white blood cell count. The cell count in turn was caused by chemotherapy given for a cancer that could never

have been improved by that treatment. We therefore thought that the decision to give chemotherapy was the error, not the procedure. In fact, the procedure for the infection had been carried out correctly. The patient may have gotten the infection just because he was sick, but in our view the decision to give the chemotherapy increased the chance that the infection would occur.

We felt we could prevent this sort of decision from happening again. We could set standards for using chemotherapy for patients with poor performance status, and we have done this. Our proof, then, is that we saw how this sort of clinical situation—increased need to treat infections—could be reduced by not using chemotherapy for patients unlikely to benefit at all.

MCO: Does TOC offer anything else to your investigative process?

RMcN: Another important TOC principle is that the goal of any system should be increased while simultaneously reducing the need for money and "inventory" to achieve it. This helps us plan interventions aimed at reducing adverse events. Typically, health care safety improvement activities involve adding people and materials. For example, one proposal to reduce length of stay (LOS) for diabetic patients at our site consisted of adding a discharge coordinator. That would have meant increasing costs and adding people to increase our goal of reducing LOS. TOC would reject this idea outright, because adding inventory or expense is a "red-flag." It means you may have missed the constraint or are using the wrong plan to make improvements. This bears repeating. If you have to add people, store things, develop areas to hold things, develop a series of policies to make sure everything is done right, and add money to improve the goal, you ought to pause.

TOC not only provides a conceptual frame for finding mistakes but also provides a model for planning improvement. We assume we can make care safer while reducing inventory management and operating expenses. We believe there is excess capacity at nearly every aspect of the delivery of medical care. The major problem in our profession stems from maldistribution of resources, policies, and procedures, not lack of services. Therefore, the goal of all safety initiatives is to produce more with less.

Let's try another example. We found that the decision to use the sliding scale for administering insulin for hospitalized diabetic patients was a core problem leading to increasing LOS and adverse events. Sliding scale is a method of blood sugar management that sets the next short-acting insulin dose according to the most recent blood glucose test. However, the use of this scale results in less control of the blood sugar level. After we outlawed the sliding scale, we found a sustainable decline in LOS and adverse events. We had failed before by focusing on discharge planning, because that added inventory and expense. Eliminating the sliding scale reduced both while providing safer care.

This shows how getting rid of decisions that do not result in the best care, rather than improving the care delivery, increases patient safety. We are often asked to improve existing systems, but after applying evidence and TOC, we often find that the system is there to support a poor plan. The poor plan is often supported by a poor assumption about how medicine is best practiced. Changing the assumption often simplifies the system, which, in turn, may decrease operating expenses and inventory while increasing the goal. Better, simpler, and sustainable should be the watchwords of patient safety.

MCO: Typically our practice in health care involves adding staff to meet increasing demands and to get more done. Your approach, as given by the TOC, seems to turn things in a totally opposite direction.

RMcN: I am glad you are hearing the message and I hope others also do. Let me try another example. We were, and are, not happy with our success in administering the flu vaccine to our hospitalized patients. We have a goal of vaccinating 100% of our patients who are eligible, want the vaccine, and are not allergic. Despite efforts to improve, however, we are missing nearly 25% of these patients. Should we add someone to our system to vaccinate all patients? That might work, but it adds capacity, because we would have to hire that person to go room to room. TOC says "red-flag." Alternatively, it was suggested

that we could find someone already working on the wards to do it, but we would have to learn which group—doctors, nurses, pharmacists—has the capacity to add this responsibility while not diminishing their own work.

TOC suggests that if we want to hire someone to do the added work, we do not have the correct idea about what is really constraining our ability to deliver 100% performance. If we need to add capacity to be perfect, we may be missing the core issue. TOC makes us ask the question, "What change will increase safe care by delivery of flu vaccine to 100% of the appropriate patient population while reducing or simplifying the system needed to do so?" Perhaps having a standing order for nurses to check each patient for eligibility for flu vaccine (they already do this, and so we are not adding new work) and then giving them the ability to order and give the vaccine without a doctor's order may improve efficiency for little added work. We cut the doctors out of the equation altogether. We are about to test this system change and measure its effects.

MCO: Has your team found any other clues for making sure you are at the core constraint to safe care for each case you evaluate?

RMcN: We have found that the more hassled we are, the more yelling we hear, and the more providers object to our proposals for change, the more likely we have found the core constraint. This is another TOC principle. TOC finds that most unsafe care or inefficient systems of delivery are set up by conflicts. This makes sense, doesn't it? We have an overly complex "nonsystem" of care delivery from which many—not patients, per se—derive benefits. Finding a core constraint and reducing inventory management and expenses means someone loses work to do. As we said above, the intersection of the complex systems designed for cross-purposes has left us with plenty of core constraints to find. This is one final concept of TOC. The goal must be known and that goal must reflect valued choices. In our view, the goal of medical care is never money. It is providing safe care while thinking of money only as an operating expense—something to be reduced. All safe care advancements will reduce somebody's income. So be it.

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