Pediatric Anesthesia

EDITORIAL

Introducing quality improvement

In 1950, a New York University professor received an unusual letter. It came from Japanese industrial leaders requesting help to improve manufacturing quality in their country. The professor taught statistics and had used it to improve farm crops and military equipment. At the time, Japanese products were considered 'cheap', and the leadership wanted to change that reputation. The professor agreed to help. He spent the next 20 years working with Japanese industries and founded quality improvement (QI) Science along the way. The rest is history: Japanese products became known for superior quality in the likes of Toyota and Sony. The professor's name was Dr. Edward Demings.

Some 60 years later, *Pediatric Anesthesia* launches a themed issue and a section in subsequent issues dedicated to QI, following the journal *Pediatrics* in this regard (1). Why now? All over the world, health care faces a critical economic crossroad: How do we deliver better and more care at lower cost? Deming's message to Japan's leadership many years ago: improving quality will reduce expenses while increasing productivity. This has been proven time and again in every industry. Now is the time for us to learn and apply QI and model the way for others in our institutions. The QI section of the journal aims to teach QI and illustrate its application through original articles. To begin this journey, I will describe the basic elements of QI, differentiate it from QA (quality assurance), and describe the format for publication of QI articles.

Quality assurance contains two types of knowledge: subject matter knowledge and profound knowledge (2). The former is the knowledge basic to the field. If the field is pediatric anesthesiology, it is medical knowledge (e.g., developmental physiology, pharmacology, anesthesia equipment, pediatric diseases). As pediatric anesthesiologists, we possess subject matter knowledge in our field. Profound knowledge consists of four elements: appreciation of a system, understanding variation, action learning, and change management (2). Profound knowledge is common to all industries, whereas subject matter knowledge is industry specific. For pediatric anesthesiologists to conduct QI, it is necessary to learn and apply profound knowledge in our work. Let us dive into the four elements of profound knowledge.

Appreciation of a system: a system is an interdependent group working together toward a common purpose. The purpose of the system must be clear to everyone in the system. The vast majority of product defects originate from system failures and not individual failures. Thus, understanding the system and getting everyone in the system to work together is key to successful QI. In health care, three broad systems exist: microsystems, mesosystems, and macrosystems. For pediatric anesthesiology, generally speaking, the microsystem is the operating room, the mesosystem is the hospital, and the macrosystem is the government. The product defect can arise from one or more failures in these systems. All too often, the leaders in these systems point fingers at each other. Improving quality requires the QI team to identify the role of each system in the defect and to get the parties to work together.

Understanding variation: high quality is all about reducing variation in the product. An entire field of statistics evolved for QI that is distinct from medical statistics (3). All manufacturing industries utilize QI statistics; hospitals are increasingly using it. In the 1920s, Demings studied under Walter Shewhart of Bell Laboratories, the founder of QI statistics, which included statistical process control, common and special causes of variation, and the control chart. Statistical process control views products as resulting from defined work processes, which contain variation. Common cause variation is the variation that is inherent to the process (the 'noise'). Special cause variation is not part of the process but arises from a special situation. A control chart plots the product specification over time; QI statistics are applied to determine the variation and significant change. The QI team aims to favorably shift the average (significant change) and to reduce common and unintended special cause variation.

Action learning: QI follows the scientific method: hypothesis, inductive and deductive reasoning, study design, and experimentation. Inductive reasoning generates a hypothesis about the system that predicts a response in which an experiment can be designed to test the hypothesis. Deductive reasoning analyzes the experimental data to validate or refute the hypothesis. In QI science, this methodology appears in the roadmap and plan-do-study-act (PDSA) cycle. The roadmap begins with a smart aim (purpose) followed by key drivers (hypotheses) about the system and designing interventions (experiments) to test the key drivers. The experiments are known as PDSA cycles. In the PDSA cycle, the first step is to plan the test of the new process. Second is to do the test; third is to study the results of the test. And fourth is to act on the results: if the test yields positive results, additional PDSA cycles are performed to evaluate the sustainability over time and

Pediatric Anesthesia **23** (2013) 569–570

generalizability to other parts of the system. For example, if a process change yields positive results in one operating room on one day, additional PDSA cycles are conducted on other days (sustainability) and in other operating rooms (generalizability) before the process is permanently adopted.

Change management: Of the profound knowledge elements, change management is perhaps the most important. Systems and people inherently resist change, whether from fear of the unknown, inertia, distrust, or lack of motivation or time. Excellent communication skills by the QI project leader along with overt support by the leadership of the system remain absolutely essential to overcome resistance and drive process improvement. QI and leadership have to go hand in hand.

QI vs QA: There are many differences between QI and QA despite clinicians referring to the two interchangeably. QA involves systematic measurement and comparison with a standard. QA is goal directed to meet the standard and is widely used in benchmarking. It is retrospective and says nothing about how to improve the product if it is substandard. QI involves a formal approach to the analysis of performance and the systematic efforts to increase it. The approach applies the elements of profound knowledge as well as systematic measurement. QI is process directed and is both prospective and retrospective. In essence, QI encompasses QA along with the methodology to improve the product if it is substandard.

Format of QI articles: Although QI utilizes the scientific method, it requires a different format for writing an article than a research article. QI focuses on making care better at local sites, rather than on generating new, generalizable scientific knowledge. QI contains a strong 'local context', whereas research is not supposed to be dependent on the site of the study. However, systems in health care around the world share similar features, and thus, many aspects of QI at one institution are generalizable. Given the local context, special statistics, action learning, and change management issues, the research format was not suitable to QI articles. In 2005, an author group drafted a standardized format for QI articles, which was refined through a systematic vetting process with input from an expert panel and public feedback and approved as the Standards for Quality Improvement Reporting Excellence (SQUIRE) (4). QI submissions to *Pediatric Anesthesia* are expected to use the SQUIRE format, exemplified by the articles in this issue, and detailed on the website (5).

Now that we have a legitimate format and the journal *Pediatric Anesthesia* to communicate QI for our specialty, we hope you will get started in this journey to learn, conduct projects, and share the trials and tribulations that go with it. We eagerly look forward to receiving original QI articles and scholarly reviews.

Conflict of interest

No conflicts of interest declared.

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doi:10.1111/pan.12167

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