How Do Quality Management Techniques Transfer from the Private Sector to Nursing Practice?

A Review of Available Case Material and Proposed Theoretical Framework

Catherine Avonyoh

Abstract

This paper studied the diffusion of quality management techniques from the private-sector technological environment into the health care sector with a focus on nursing practice. The paper used a brief systematic review to assemble and synthesize article content, to understand the range and pattern of quality management techniques that are in use in the private sector. The study found that most usage of quality management tools by nurses consists of *ad hoc* remedies rather than comprehensive solutions that might more genuinely represent effectively crossing the boundary into the private-sector technological environment. Adopting private-sector practices would, contrarily, promote the integration of mutually reinforcing solutions across departmental boundaries within the adopting organization rather than attempt to change a single practice in isolation from other practices. The study concludes with recommendations for nurse practitioners to promote comprehensive programs, network with practitioners at other medical institutions, and engage in self-study.

Keywords: Malcolm Baldrige, nursing, quality improvement, quality management

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The flow of quality management techniques from the private sector into nursing practice is simultaneously an ongoing fact of the modern health care industry and a dynamic that should be occurring more fully and regularly than it is. Through the Malcolm Baldrige National Quality Award (MBNQA), the federal government of the United States promotes the sharing of best practices across sectoral boundaries, to improve the quality of operations and services in American organizations of all kinds, including health care institutions. The MBNQA is a comprehensive program, in that it covers all commonly accepted functions, such as leadership, employees, customers, and operations. It is compatible with all modern quality management techniques, including the statistical ones. The Baldrige Framework, which guides the MBNQA, places the greatest emphasis on customer feedback about quality (Kelly et al., 2010).

Evidence-based practice (EBP) is the 21st-century standard of nursing care in the United States. This standard of practice emphasizes consultation of empirical data to judge the viability of health care solutions and improve operations in health care settings. Beyond EBP, the adoption of quality-enhancing tools and technology from private industry can complement EBP, because it involves an analogous approach to judging the usefulness of selected tools and techniques in the private-sector technological environment. In this paper, the focus is on a subset of those tools and techniques, known as quality management tactics and strategies, or process improvement methodologies. The reason for this focus is that health care institutions across the country are currently engaging at a high level in a search for ways to improve processes of all sorts, from highly technical medical procedures to the customer service side of the operation.

Many nurse practitioners are actively trying to improve patient care quality but have little conception of proven quality management tools and techniques from private-sector experience (Kelly et al., 2010). Many statistically sound practices exist, alongside a very solid set of quality improvement methodologies that have their origin in notable experts like Walter Shewhart (the original quality control expert), W. Edwards Deming, Joseph Juran, and Taiichi Ohno. The last of these figures invented the Toyota Production System, which established most of the familiar quality control and management techniques behind Japan's phenomenal recovery and growth in the latter half of the 20th century. Modern quality management techniques with roots in the thinking of these historical figures are applicable to all types of organizations, including those dedicated primarily to delivering services to customers, such as health care. There is therefore little need to undertake concerted, painstaking efforts to adapt current methods to nursing practice, as the premises of quality management already fit the field. The research question for this study is accordingly as follows:

RQ. *Through what mechanisms have proven quality management techniques from the private-sector technological environment diffused into nursing practice in the United States?*

Literature Review

The technological environment pertaining to the private sector, from which the health care sector may draw many quality management practices, is the product of a history of process-based innovations throughout the 20th century. This history begins with statistical quality control in the United States and follows with the adoption of those techniques in Japan starting in the 1950s, where substantial innovations occurred of a practical nature. The global competitive environment of the 1980s, in which Japan rapidly became the main competitor of the United

States based on those same innovations, then created pressure for the American private sector to absorb those new practices into its own technological environment.

This literature review accordingly focuses on the tools and techniques of quality management that have developed in the private sector primarily after the era of Japan's influence on American practice. It examines that subset of such techniques that is useful to nursing practice. The literature review starts by citing some of the key sources of quality management innovations and then provides some descriptive information on selected methods.

Walter Shewhart

Walter Shewhart initiated the American quality management movement with his 1931 book, *Economic Control of Quality of Manufactured Product* (Shewhart, 1931). Shewhart's emphasis was on controlling variation. This would remain the focus in quality management forever, supplemented later only by a focus on the customer's feed-in to the process. All basic quality control processes, such as the familiar X-bar chart and the R-chart, originated with Shewhart. The X-bar chart shows the analyst whether a process is starting to move off from the optimum. The R-chart shows the range of the observations on the X-bar chart. Together, the two charts show all necessary data to determine whether a significant change is occurring in a process, but without the need for advanced statistical techniques.

Shewhart's (1931) treatise is correctly construable as the first scientific enunciation of the modern quality movement, despite the fact of George Stanley Radford's (1922) prior work, *The Control of Quality in Manufacturing*. This earlier work established the practice of sampling the final product after manufacturing. Radford's pronouncements about the technical application of statistical measurement were certainly correct, and Radford's approach to quality control would indeed become the mainstay of manufacturing for subsequent decades. However, the emphasis

on sampling the output, rather than attending to the process steps leading to that output, would ultimately prove to be the bane of American quality control, against which W. Edwards Deming (discussed below) especially would rail in later history. For this reason, Radford has no substantive place in the modern quality movement, except to represent the way of the former world, before anyone had developed an idea of process-oriented measurement.

Some of Shewhart's methods are present in discussions of quality improvement in nursing practice, but virtually always in the form of statistical charts to address singular issues. For example, one finds explicit reference to Shewhart's methods in Hayati, Maghsoodloo, DeVivo, Thomas, and Lemiere (2008), who have reported on a straightforward program of organization change involving the adoption of Shewhart's X-bar charts as a way to monitor occupational respiratory hazards and the potential for asthma in the workplace. Hayati et al.'s (2008) report is most valuable in its demonstration of how to apply Shewhart's principles and create a workable control chart. As a potential example of quality management intervention, Hayati et al. (2008) have presented a simple, *ad hoc* intervention, but one that is both maximally generalizable and benefiting from the firmest of scientific foundations.

Aragona et al. (2016) provided another example of the use of Shewart's control charts, in an intervention designed to track and increase nurse presence during family-centered rounds (FCRs) at a pediatric hospital. In this case, the task of plotting mean nurse presence ratios at all hours of authorized FCRs served to reveal opportunities to ask questions about observable changes. Brown, Perkins, Blust, and Kahn (2015) additionally used Shewhart's X-bar chart methodology to reduce the mean age of pediatric visits in high-risk communities. In this application, the adoption of a welcome call registry demonstrably reduced the mean age and thereby increased the odds of identifying treatable conditions earlier in the respective children's

lives. This method had the ancillary effect of increasing the total number of children actively monitored in the designated at-risk communities within a 9-month period.

Boulkedid, Sibony, Bossu-Salvador, Oury, and Alberti (2010) used a variation of the X-bar chart, known as the cumulative-sum (CUSUM) chart, to monitor changes in quality indicators in an obstetrics unit. Quality indicators consisted of the relative frequency of selected incidences of normal procedure, such as scheduled and unscheduled caesarean sections, admission into intensive-care units, and blood transfusions. The purpose of the CUSUM charts in this application was to identify whenever the incidence of a given procedure clustered abnormally in the population. Chaboyer et al. (2012), discussed below, similarly used the familiar X-bar and R-charts to measure variation in discharge timing from an intensive-care unit. Some studies have used Shewhart's methods while rather inaccurately calling them Six Sigma (*e.g.*, Eldridge et al. 2006).

Armand Feigenbaum

Armand Feigenbaum invented the idea of total quality control, which refers to quality control as applied to every possible process in the value chain. Without this important insight, many people would still simplistically be sampling products after manufacturing them, following Radford's (1922) methodology, to see how many have errors. Feigenbaum's (1951) seminal work, called *Quality Control*, established most of the foundational concepts of quality, including a definition of quality based on the customer's internal set of expectations regarding a product or service. Feigenbaum added the customer focus to the science of quality management, which would come to influence Japanese practices in a fundamental way after World War II.

Although Feigenbaum's ideas relating to quality form the basis of what would later become total quality management, published accounts of nursing interventions appear never to

cite Feigenbaum as a relevant source of quality method. Rather, Feigenbaum's scholarly activities continued into the early years of the 21st century, and the trajectory of Feigenbaum's writings has moved toward innovations in management, education, and government, outside the domain of nursing practice. As Feigenbaum's published ideas have gravitated increasingly toward refining the definition of quality (always as a customer-perceived characteristic of a product or service), those ideas have failed to apply substantively to nursing practice. Rather, Feigenbaum's ideas today seem to project specific facets of quality to pursue, which may only sometimes have self-evident applicability to nursing practice. Such facets include performance, features, product or service reliability, conformance to expectations, durability, product or service serviceability, relevant aesthetics, and the customer's own perceptions of quality (Garvin, 1987). While some of these elements may indeed apply to the measurement of quality in nursing practice, they seem mostly unnecessary, given the manifest measures of quality inherent in the health care field.

Joseph Juran

The same year that Feigenbaum published his seminal work, Joseph Juran published his own treatise, called the *Quality Control Handbook* (Juran, 1951). This book caught the attention of Japanese engineers, who therefore called Juran to Japan to teach them his methods. Juran's quality orientation emphasized Pareto optimality, continuous improvement, the use of quality teams, and the philosophy that essentially the same quality methods as used in manufacturing are also useful in virtually all other aspects of life. Indeed, the concept of continuous improvement is a mainstay of quality management today. Kaizen (which simply means improvement) has come to mean, due to its effective application, continuous quality improvement.

Few studies address Juran's concepts directly, but some studies at least cite the theorist in reference to quality improvement methods in general. Lemieux-Charles et al. (2002) evoked Juran in a study of the effects of quality improvement methods in team settings, although this particular study falls outside the domain of organizational interventions. A key focus for Juran was how to improve team functioning. Therefore, Lemieux-Charles et al. (2002) have at least cited the appropriate authority on the subject. This study succeeded in demonstrating that internal and external observers of team-level quality improvement techniques make different assessments of the effects of such techniques on team performance.

W. Edwards Deming

W. Edwards Deming is most famous for his 1986 book *Out of the Crisis* (Deming, 1986), which contains his famous 14 points of how to manage a quality company and introduces the four-step process improvement cycle previously advanced by Shewhart (plan-do-study-act, or PDSA). Deming invented no new ideas, but he was an effective teacher. Like Juran, he went to Japan (separately). He was also the most prominent herald of the need for quality control in 1980s America, where manufacturing companies were in a kind of crisis of quality management, compared to the increasingly successful Japanese at the time. Deming's earliest publications, dating from the 1940s, were all about statistical methods. His fixation during those early years was to find ways to improve sampling techniques.

Aragona et al. (2016), discussed above, applied the PDSA cycle to process improvement in the context of an effort to increase nurse availability during scheduled family-centered rounds in a pediatric unit. Brown, Perkins, Blust, and Kahn (2015) also used the PDSA cycle, to assess and improve population health monitoring in conjunction with a pediatric medical home. In this application, the PDSA cycle involved integrating monitoring steps into a routine program of

community outreach. Program coordinators recorded data during their rounds and then sent them in anonymized form to analysts to determine whether the data justified follow-up actions. Duncan and Haigh (2013) used Shewhart's X-bar chart, with several variations, in a longitudinal study to assess the effectiveness of abdominal epidural analgesics in 293 surgical patients. They used an S-chart (in place of an R-chart) to measure standard deviation over the study period. Following the same charting principle, they included a P-chart to track the percentage of nonconformance over the period.

So-called SMART criteria (specificity, measurability, attainability, relevance, and time-boundedness—the specific terminology often varies) constitute a normative goal-setting model, which often seems to occur in the context of quality control, especially where authors have mentioned Deming (*e.g.*, Brown et al., 2015). Strictly speaking, this model falls outside the domain of quality management, but its appearance in the literature merits at least the present explanation. One may construe the application of SMART criteria as functioning on the same practical level as that of the PDSA or DMAIC (*cf.* Six Sigma, below) approaches to quality improvement.

Philip Crosby

Among the American founders of the quality movement, Philip Crosby was the only actual businessman. He wrote several books, the first of which was *Cutting the Cost of Quality* (Crosby, 1967). His main message was that quality, long seen as expensive, despite its benefits, was inexpensive, as long as practitioners applied the cost associated with quality improvement early rather than late in the process sequence. Crosby came up with four so-called absolutes of quality management: (1) the definition of quality (conformance to requirements); (2) the system (combating defects); (3) the standard of performance (zero defects); and (4) the way to measure

it (in terms of costs). Crosby quickly discovered that improving a process early in its cycle cost less than doing so later in the cycle. He observed a system of calculating total costs, between the cost of quality management (or cost of abatement) and the cost of the defects themselves.

Crosby's quality criteria have invariably served as normative guidelines in nursing practice, as no substantive quality improvement intervention in nursing practice based on any specific idea advanced by Crosby is apparent in the literature. Anderson and Webster's (2001) appeal to apply Crosby's zero-defects concept to nursing practice in place of the common fallback methods of negative incentives and the use of coercion to reduce error, for example, merely listed the prospective benefits of the philosophy. Although Silén-Lipponen, Tossavainen, Turunen, and Smith (2005) offered a more empirically oriented treatment of the zero-defects concept, even their study merely polled best practices across several organizations.

Kaoru Ishikawa

Kaoru Ishikawa is most famous for his cause-effect diagram (the Ishikawa diagram, also known as the fishbone diagram, due to its appearance), but his fixation was the use of graphical measures. He insisted on using the full range of graphical tools to render quality measures highly visible and therefore optimally intuitive to decision makers. Ishikawa advocated the use of check sheets to track different categories of defects, along with Pareto charts to organize those categories to prioritize sources of error based on their relative pervasiveness in the process under consideration. He also advocated flowcharts to map processes and thereby find visible ways to improve them, histograms to plot various kinds of measures for clarity, scatter diagrams to establish possible correlations, and the control charts of Walter Shewhart for purposes of identifying whenever a process begins to deviate from standards. Ishikawa published a book in 1970 on quality circles (Ishikawa, 1970).

Aragona et al. (2016), discussed above, used Pareto charts to ascribe different categories of causes to nurse absence during family-centered rounds. Their study found the greatest impediment to nurse attendance to be the need for nurses to administer medications during the allotted time slots. Next in importance was the patient load itself, which often placed an upper limit on nurses' availability. Duncan and Haigh (2013), discussed above, used a Pareto diagram method to categorize different reasons for the early removal of catheters in patients who had undergone abdominal surgery. This approach enabled the nurses to attend to specific solutions in response to the most common causes of failure first, as part of a long-term process improvement study.

Duckett and Nijssen-Jordan (2012) have provided an example of the use of the Ishikawa fishbone diagram for displaying the causal factors behind unnecessarily extended stays in hospital emergency units. As exemplified in this approach, the Ishikawa diagram enabled the display of a large number of causes, categorized into a manageable range of causal types, but without the advantage of ascribing quantitative comparisons as with the Pareto diagram. For Ishikawa, by comparison, a Pareto diagram was a natural supplement to the fishbone diagram, as the idea was to present causal data from several perspectives and thereby heighten analysts' intuition about them. In the application of Duckett and Nijssen-Jordan (2012), the result was nevertheless some degree of success in addressing common causal factors and reducing mean emergency unit time per patient.

Genichi Taguchi

Genichi Taguchi is most famous for the Taguchi principle, whereby one observes that the greater the variance in any process, the costlier it is. This is true regardless of how one chooses to measure variance, such as whether one translates variance as risk or as fuel expenditure. The

choice of process is unimportant, as long as the process aims for a singular target (thus, processes with divergent performance targets, such as artwork, are exceptions). Unless process variance is due to variance in demand or necessary variance in product or service content, variance equals cost. Taguchi's books usually have Taguchi's name in the title, such as *Taguchi on Robust Technology Development* (Taguchi, 1997).

Few studies that address Taguchi's variation principle appear to coincide with studies of interventions in nursing practice. Moreover, few studies appear to address variation *per se* as an issue to address in nursing practice. Nevertheless, some studies consider variation to serve as an important indicator of the absence of quality. Chaboyet et al. (2012) have provided such an example. In this study, the objective was to reduce unnecessary delays in releasing patients from intensive care, while simultaneously decreasing hospital mortality and decreasing the incidence of subsequent hospital readmission. Although Chaboyer et al. (2012) used standard control charts from Shewhart, they focused additional attention on the role of sheer variation in providing an indication of a lack of quality. As the institution at issue addressed the causes of unnecessary discharge delays, the variance in discharge timing also decreased. This fact was most readily visible in the authors' R-chart, which depicted the decreasing range of time beyond 48 hours per patient discharged.

Taiichi Ohno

Writers often overlook Taiichi Ohno among the seminal thinkers of the quality movement, but Ohno's invention of the Toyota Production System (TPS), later usually referenced either as just-in-time manufacturing (JIT) or lean manufacturing, has become the mainstay of industrial quality management around the world. This system includes a thorough list of seven types of waste to eliminate in the workplace (Ohno, 1988). The seven types of

waste, coupled with the necessity to seek them out and minimize their prevalence, is the foundation for the entire TPS. That is, the search for waste forces the manager to identify every source of process lag, such as the inefficiencies in the arrangements in the process sequence, the time necessary to move from one place to another, and the potential for errors to occur due to bottlenecking.

The application of Ohno's techniques to nursing practice has mainly occurred in the form of JIT principles, but most discussions have been normative or conceptual rather than in response to actual interventions (*e.g.*, White, 2006; Whitson, 1997). By comparison, Murtaugh, Pezzin, McDonald, Feldman, and Peng (2005) sought to assess a system of JIT information provision to enhance the use of EBP methods in nursing practice. This study was experimental rather than interventionist in nature, but it showed that a practice of providing nurses with reminders to investigate research information in conjunction with specifically identified patient cases significantly increases the use of EBP solutions in the affected clinics. In another study, Helman, Lisanti, Adams, and Davis (2016) applied JIT principles to nurse training for low-frequency but high-risk patients, featuring the activation of a programmed training activity as a refresher in conjunction with a specific patient case.

Bill Smith

Six Sigma, invented by Bill Smith at Motorola in 1986, may be the most important quality management technique of the statistical variety (Adams, Gupta, & Wilson, 2003). Six Sigma is a statistical methodology that fully exploits the Taguchi principle as its foundational logic. In Six Sigma, analysts first measure a process, including its mean and standard deviation. They then set a goal to reach the next standard deviation of improvement by creatively contriving ideas to improve processes, often with considerable trial and error. They stop at Six

Sigma, which refers to three standard deviations to the right and to the left of the mean in a normal distribution after accounting for an additional margin of 1.5 standard deviations to allow for long-term process shift. The Six Sigma standard thus effectively means 4.5 standard deviations to the right and to the left of the mean in a normal distribution representing process output.

The principle of Six Sigma appears to have received appreciable recognition in nursing care practice, but most applications have focused on the principle *per se* of reducing variation more than abiding by the strict quantitative criteria specified in formal Six Sigma methodology. For example, Eldridge et al. (2006) applied Six Sigma principles to improve compliance to the guidelines of the Centers for Disease Control (CDC) to ensure proper hand hygiene in intensive-care units. This study mainly applies Shewhart's standard control charts to show changes in compliance after a composite intervention consisting of training, information, and sanctions. Another application of Six Sigma methodology, that of Sanders and Karr (2015), focuses instead on the method's DMAIC (definition-measurement-analysis-improvement-control) cycle to reduce variance in cycle time for returning specimens from medical technologists. As in the case of Eldridge et al. (2006), a decrease in variation was the outcome of this intervention, but the authors again stopped short of applying the Six Sigma methodology in its full form.

Methodology

This study used a limited systematic review as its method. The procedure involved entering the keywords [nursing], [Malcolm Baldrige], [quality improvement], and [quality management] as a single search term in the all-database window in a university library's online system, which produced a limited array of articles. Additional searches using the names of noted quality management innovators of the past helped expand the results. Terms of greater

specificity, such as Six Sigma and technological environment, would be necessary only if the noted terms failed to produce results that overlapped sufficiently with the concept of the technological environment. The next step was to identify which databases the system mainly selected, and to repeat the process in individual databases, to generate a longer list of articles of differing levels of relevance to the search phrase. A review of each article for content relating to nursing practices and patient care quality would then narrow down the list to the most relevant articles.

Results

The results of the literature search produced an array of articles categorizable in two types: (1) MBNQA; and (2) non-MBNQA. Since the search term included MBNQA, the noted division in the literature stems from the fact that many sources merely mention the MBNQA criteria without actually applying them. This separation proved useful for this study, because it permitted the display of possible contrasts between studies that have used MBNQA criteria, such as those that were planning to compete for the national award, and those that pursued quality management initiatives outside the MBNQA context. The categories are as shown in Tables 1 and 2.

Table 1

MBNQA Approaches

Category	Study
Case Studies and Historical Reviews	Case study, comprehensive, thought leader, customer service quality (Smith, 2003)
	Case study, comprehensive (VHA) (Ohldin et al., 2002)
	Case study, comprehensive (VHA) (Shirks et al., 2002)
	History of MBNQA health care institutions (Arnold et al., 2015)
	History of MBNQA health care institutions (Duarte et al., 2013)
Formal Methodologies or Strategic Analysis	Six Sigma for process improvement, cystic fibrosis clinic (Smith et al., 2011)
	Comparison, MBNQA vs PHAB (Gorenflo et al., 2014)
	Comparison, MBNQA vs ACCME (Leist et al., 2004)
	Stakeholder analysis (Reyes-Alcazar et al., 2012)
Other	Self-assessment: Survey-based (Shields & Jennings, 2013)
	Self-assessment: Survey-based (Colombo et al., 2011)
	Self-assessment: Survey-based, empirical support of performance link (Goldstein & Schweikhart, 2002)
	Prescriptive: General prescriptive approach (Gropper, 1997).
	Thought leader: Interview (Scarrow, 2010)
	Specific process innovation: Diabetes (Foster & Pitts, 2009)

Table 2

Non-MBNQA Approaches

Category	Study
Specific Process Improvement	Patient care transition (Dy et al., 2015)
	Process improvement, literature review (Hillier et al., 2013)
	Process workflow improvement, mobile application (Huynh et al., 2011)
	X-bar chart for industrial respiratory monitoring (Hayati et al., 2008)

	X-bar/Pareto for family rounds at pediatric hospital (Aragona et al., 2016)
	X-bar chart for community monitoring of at-risk children (Brown et al., 2015)
	X-bar chart/Pareto chart to improve effectiveness (Duncan & Haigh, 2013)
	CUSUM charts to monitor clustering, obstetrics issues (Boulkedid et al., 2010)
	Ishikawa fishbone to find causes of delay (Duckett & Nijssen-Jordan, 2012)
	X-bar chart/R-chart to decrease discharge time (Chaboyet et al., 2012)
Training-Based Interventions	Parental training, neonatal (Joseph, Goodfellow, & Simko, 2014)
	Patient training, hemodialysis (Feizalahzadeh et al., 2014)
	Training in quality improvement (Davis et al., 2012)
	Just-in-time training for low-frequency, high-risk patients (Helman et al., 2016)
	X-bar/Six Sigma for hand hygiene compliance (Eldridge et al., 2006)
Formal Methodologies or Strategic Analysis	Use of the Strong process improvement model (West, 2016)
	Stakeholder analysis (Reyes-Alcazar et al., 2012)
	Balanced scorecard (Impagliazzo et al., 2009)
	PDSA to support family rounds at pediatric hospital (Aragona et al., 2016)
	PDSA/SMART to monitor at-risk children (Brown et al., 2015)
	European Foundation for Quality Management (EFQM) (Leigh et al., 2005)
	DMAIC approach (Six Sigma) to decrease cycle times (Sanders & Karr, 2015)
Other	Self-assessment: Magnet hospital, Nursing Work Index (NWI) (Wagner, 2004)
	Informatics: Electronic medical records (Fareed et al., 2012)
	Informatics: Just-in-time reminders for EBP solutions (Murtaugh et al., 2005)

Theoretical Synthesis

The case study base of successful interventions seems to suggest that comprehensive interventions produce more durable process improvements than do *ad hoc* interventions. This observation seems to reflect the fact that *ad hoc* fixes have low inertia and may therefore unravel over time (Joseph, Goodfellow, & Simko, 2014). Conversely, narrowly focused efforts, such as interventions to improve patient care transfer, are easier to implement and approve than are

formal programs (Fareer et al., 2012). The issue here seems to be that medical institutions still often have heavy bureaucracies, which make it hard to put on large-scale quality management efforts. The exceptions are mostly those hospitals that have decided to go the MBNQA route (Leist et al., 2004; Smith et al., 2011). Otherwise, even among medical institutions that claim to be open to all possible suggestions, until they legitimately move in a comprehensive quality improvement direction, it may remain difficult for the nurse practitioners of the institution to push for changes of a comprehensive nature. Moreover, hesitation to do so is likely to weaken the enthusiasm to challenge the system at all. Nurses tend to work extremely difficult schedules already, so any institution that merely waits for them to push for quality improvement is inadvertently feeding its own inertia.

For nurse practitioners, comprehensive quality improvement (like MBNQA) creates more durable effects than do specific, small-scale efforts (such as from brainstorming) because multiple functions reinforce one another (Reyes, Casas, Herrera, & Torres, 2012; Smith et al., 2011). This mutual reinforcement is the only way to achieve comprehensive quality improvement. Comprehensive quality improvement is also the goal of the federal government of the United States and is consistent with the philosophy of all quality management scholars and thinkers cited previously. Only a comprehensive program makes sense for any organization that wants to make quality improvement a permanent part of operations instead of a temporary one.

Figure 1 identifies the main forces behind the choices of process improvement methodologies adopted in medical institutions. Each box includes a kind of reference to a category. The MBNQA box only specifies the MBNQA, but it implies all other comprehensive solutions as well and therefore makes sense in this context. Thus, the criteria for the Deming Prize, issued by Japan each year, also fit there, as do the ISO 9000 criteria or the European

model of quality criteria. The specific but durable collection of remedies lists the formal, proven remedies that have come out of the quality movement. The box only mentions the three most prominent approaches as examples, namely, Six Sigma, kanban, and error-proofing. Six Sigma, as previously described, is a process improvement technique based on the Taguchi principle that variation is inherently costly. Kanban refers to the use of a visible display of accomplished and unaccomplished process steps, which permits easy and visible adjustment as a product advances through its processes. Error-proofing refers to making physical alterations to products or devices to prevent inadvertent errors (safety caps on medicinal containers are an example).

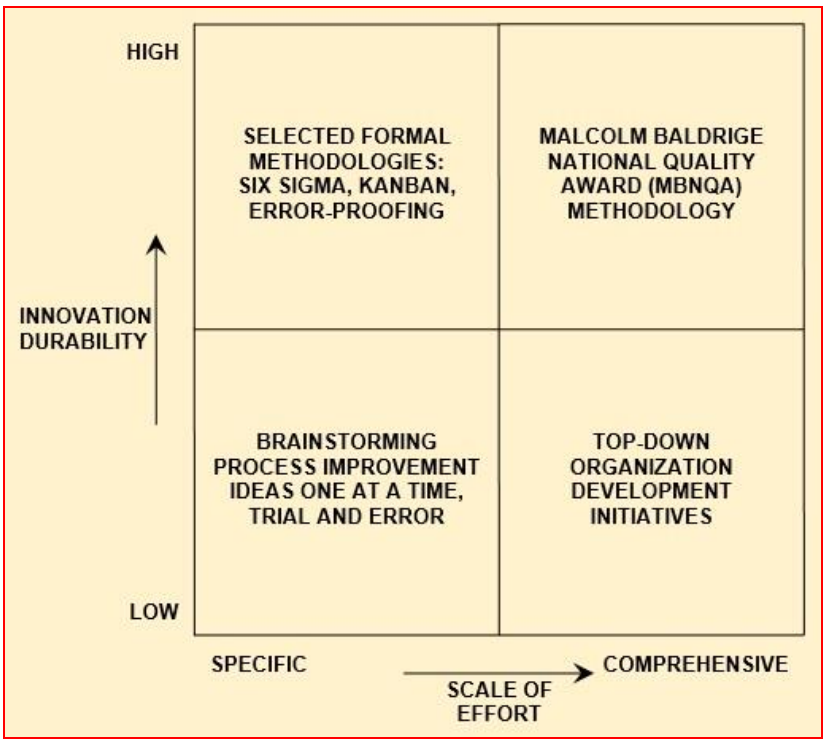

Figure 1. Main types of quality improvement efforts in medical institutions.

It is feasible to apply Six Sigma to services as well as to manufacturing, since it is possible to measure the mean and standard deviation of service cycle times. In this context, a cycle time is the mean time necessary to carry a client from initial intake to release (Andritsos &

Tang, 2014). The difference between lean manufacturing and Six Sigma is important: Six Sigma looks for minimizing variance, while accepting a given mean, rather than necessarily decreasing the mean. Short of a clear decision to decrease cycle times (which is admittedly important, now that the federal government of the United States is indeed publishing cycle times for individual health care institutions), simply stabilizing them to improve sequencing and resourcing can already represent a considerable step toward quality improvement. Kanban, for its part, in all of its forms, is a simple method of using visible symbols to indicate when to act. For example, if a nursing unit must order new syringes at a certain point, labeling the one with a red dot that is a certain count before the end creates an automatic notification. Other kanban methods involve putting cards on a board to indicate how many units in a process phase require work.

Figure 2 then displays a conceptual diagram to highlight the nature of the relationship between ease of adoption, which refers to any kind of quality improvement tool or technique, and the nature of the program, which distinguishes between informal (considered inferior) and formal (scientific or industry-proven, hence superior) approaches. Ease of adoption is greater when an organization seeks to augment a preexisting program because the uncertainty of fit of the innovation is lower than in the installation of a completely new program (Dy, Ashok, Wines, & Rojas Smith, 2015; West, 2016). For nurse practitioners, narrowly focused process improvement programs of an informal nature are therefore easier to adopt than are those of a formal nature, even though this fact may cause practitioners to overlook questions of scientific validity or reliability and consequently commit more errors. When institutions pursue remedies that are easy to adopt, they end up with small process improvements and often *ad hoc* remedies with no basis in any literature.

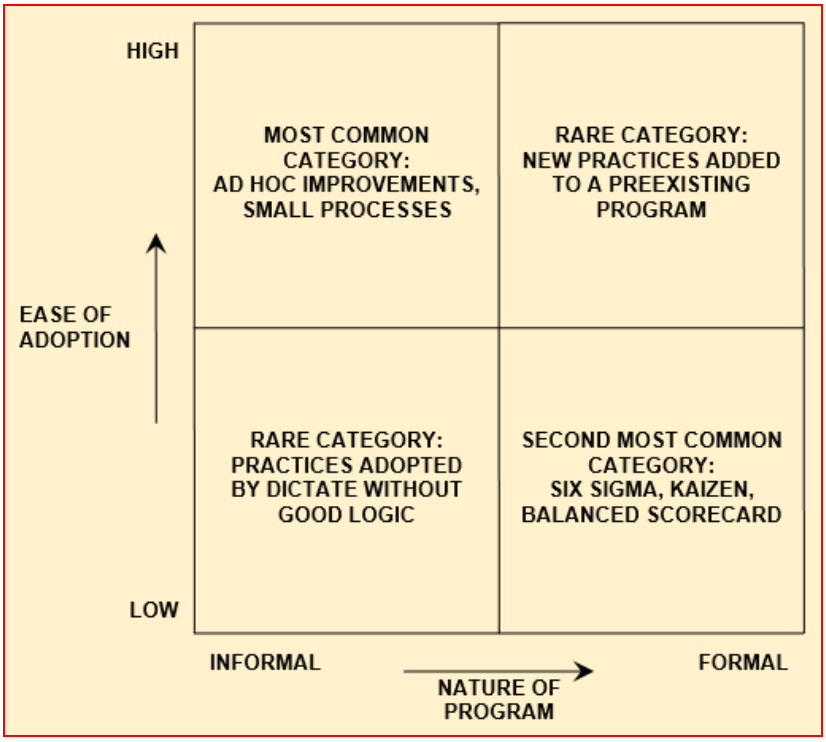

Figure 2. Relationship between ease of adoption and nature of program.

Discussion

This essay studied the kinds of quality management methods used by nurse practitioners in the most relevant peer-reviewed articles. The findings show that most remedies reported are *ad hoc* efforts. These efforts are easier to study than are comprehensive efforts because the latter only let scholars study one company at a time. For this reason, most studies of comprehensive efforts are case studies. The findings also suggest that some vulnerability exists in organizations that remain content to pursue informal, *ad hoc* remedies, since those remedies usually have only weak ties to the rest of the institution and can therefore unravel over time. Only comprehensive solutions have staying power.

Improvements in nursing practice merit much more solid efforts than are currently most common in health care institutions. It is also worth recognizing, nevertheless, that it is difficult

for many nursing units to undertake large-scale change, due to bureaucratic impediments. It is therefore important both to recommend comprehensive quality management solutions and to provide ideas about how to make *ad hoc* improvements work. The implications for nursing practice accordingly start with the promotion of the idea of comprehensive remedies in institutions, such as by advocating self-assessment and self-improvement using the MBNQA criteria. Next, nurses should join quality management organizations, such as the American Society for Quality (which assists the National Institute of Standards and Technology to confer the MBNQA each year), to keep close to quality issues and network with others who have the same objectives. Finally, if nurses must plan *ad hoc* remedies, they should do so in as comprehensive a manner as possible. That is, they should try to tie them into other quality improvement processes in other units, so each process optimally helps keep each other process in line.

Future researchers should probably team up to study comprehensive programs across as many institutions as possible. It may be feasible, as an alternative, to undertake studies of the historical record of MBNQA winners. The MBNQA list of health care institution winners presents detailed information concerning how those institutions won the award. The recommendations for future research accordingly start with establishing networks with professionals at other organizations, with a goal to collaborate and thereby ideally study comprehensive programs in clusters rather than individually. Researchers should use the network to collect measurement data from as many institutions as possible. Customer quality data are already available to everyone through the federal government of the United States, but other data, such as training hours, work schedules, and so forth, can provide important controls in empirical studies. Finally, a more methodical assessment of different kinds of practices in the

health care industry would be useful. The articles produced by the search in this study show that many *ad hoc* remedies are available for review. It may be possible to do a kind of systematic review using quantitative measures, such as in the Cochrane Collection, to assess effectiveness.

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