

Benchmarking That Matters: A Proposed New Direction for Clinical Engineering

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Benchmarking, not a new concept to clinical engineering (CE) managers, continues to be redefined and promoted as a “must have” by CE professionals. How we use benchmarking and how we *should* use benchmarking is the crux of this article. We need to prioritize and focus our resources in a way that matters most to our fellow caregivers and patients.

There is a lot of valuable information to be gained from benchmarking articles offered by AAMI, ECRI Institute, and trade journals. And, as one might expect, there is a wide range of suggestions within the CE community as to which benchmarks are the most important, how to collect the data, and how various benchmarks can or should be used to support the growth and further development of a CE department.

All too often, those of us responsible for managing CE departments fall into the trap of collecting and presenting data simply because we have always done it. This practice is truly a “sacred cow.”

Why do we collect data? We do it to justify our exist-

tence, to prove our worth, and/or in an attempt to justify needed additional resources. We have been guilty of this for the past 30 years. We have always generated a year-end report for senior management in an attempt to wow them with all kinds of data: preventive maintenance (PM) compliance, response time, open vs. closed work orders, productivity, cost-of-service ratio, in-house vs. vendor repairs, etc., all nicely tabulated and formatted to identify trends. Impressive, no?

Yet, can we really see significant, actionable outcomes when looking at year-to-year comparisons? Surely some metrics go up, some go down, others barely change. Then we compare our data by looking at similar metrics from other organizations. Interpretations of the results dissipate into concerns over data accuracy and integrity. After all, our CE profession can't even agree on how to count devices (is it one monitor, or one with five modules); what purchase cost to use (list price vs. our negotiated top-secret price); or how to define a productive employee (captured work hours or available hours).

With all these benchmarking variations and ambiguities of how and what to measure, is it any wonder that it has been challenging for CE professionals to determine how best to use them? Depending on how our numbers compare, we can look either better or worse than the CE program across town. Yet, both can have little or an unquantifiable impact on the quality of care and on the staff efficiencies of those we serve. Using our sacred cow benchmarks, we just don't know.

Nobody (Except Us) Cares

Two years ago, after attending a benchmarking-related session at AAMI's Annual Conference & Expo, we concluded that something was missing. None of the commonly measured program performance measures define or even come close to quantifying the value or impact that the provision of CE services has on *why the hospital exists*, i.e., the delivery of quality patient care. While the search for meaningful operational performance benchmarks has led to interesting data elements, we still, as a



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profession, struggle with coming up with answers to the following questions:

- Why are so many CE departments understaffed?
- Why are many CE departments still focused on performing electrical safety and preventive maintenance (PM) inspections as the justification for their need?
- Why is it that some CE departments seem to have a problem getting noticed, getting the support, and recognition they deserve from senior management?
- Why do the so-called “healthcare right-sizing consultants” always focus on number of techs per bed, or per patient discharge, and never seem to really understand what CE is all about?

Recommendations for Better Benchmarking

- Ask your clinical staff to validate what’s important to them to measure/benchmark and see if the response you get matches our project findings.
- Ask your CMMS vendor to incorporate new data elements into the software to allow you to track the outcome metrics (impacts of device failure) we have defined in this project.
- Ask your CMMS vendors to develop an online survey tool that you can send out in response to each corrective maintenance work order so that you can obtain real-time feedback on if and how the device failure impacted patient care and/or clinical staff productivity.
- Ask your CMMS vendors to provide reports to allow you to identify which device types, along with which care areas, were impacted (i.e., extended stay, error in diagnosis, safety compromised, etc.) by the device failure.
- Ask your CMMS vendor to incorporate a means for you to identify what percentage of STAT calls you were able to resolve in real time (i.e., you were the hero), tabulated by device type and clinical area.
- Share your findings and use the data obtained to improve your departmental operations as it relates to having a quantifiable impact on delivery of care.

- Lastly, what makes one CE department better than others? Is it cost? Percentage of PMs completed on time? Or is it how they are an integral player in the delivery of effective quality care?

Perhaps the benchmarking numbers game should someday be the subject of an iconoclast session at the AAMI conference, starring various CE staff members all competing for the “best in class” rubber ducky prize as they find the best way to show meaning and value in the numbers. Take one example, the metric related to total program cost. Cutting cost is easy: Simply quit doing scheduled inspections, cut your staffing, stop fixing broken equipment. Never mind the fact that you will eventually get a citation from an inspection agency, and that your response time and time to repair malfunctioning or broken devices will skyrocket. But hey, your cost-of-service ratio benchmark will make you look great, for the time being! What a great program you have! (Not really.)

While contemplating how to measure, track, and report your benchmarks, consider the reality that nobody cares, except for you and the individuals you have spent years convincing that benchmarks are important and relevant. Other than perhaps the chief financial officer (the money), the compliance/safety officer (the regulation), and your boss (the person you need to impress), none of the individuals responsible for direct patient care give a hoot about our outdated CE program benchmarks.

What Is Important and To Whom?

Benchmarks should ideally be based on metrics that are relevant to the customer and related to the services provided by the organization. It would be hard to find a clinical caregiver whose daily tasks and ability to take care of patients aren’t impacted by:

- CE’s ability to minimize device downtime by having sufficient skills and resources to repair broken equipment quickly
- CE’s ability to resolve issues in real time and be the “hero,” especially in response to STAT requests
- CE’s ability to have a positive impact on a patient’s length of stay
- CE’s ability to impact the probability that a test or procedure doesn’t need to be delayed or rescheduled
- CE’s impact on clinical staff job satisfaction
- CE’s impact on clinical staff productivity

Put another way, if you ask clinical staff what’s impor-

tant to them, as related to CE's support of patient care technology, you will find these common themes:

- Equipment availability: Is the device operational and ready to use when I need it?
- Equipment reliability: Does the device work properly, and is it accurate?
- Equipment support: If I need technical help and I call CE, is there service staff available to respond and resolve the issue?

All too often, we use our computerized maintenance management system (CMMS) databases to code the reason for the equipment failures, time to repair, cost of parts and labor, and severity of the repair. While these may be important to track, these measures tell us nothing about the impact CE's response had on patient care. When a clinical device or system fails to operate properly or isn't available when needed, consequences for the patient or staff include:

- A delay in provision of care, treatment, or test
- Injury (or worse)
- Extended patient stay
- A misdiagnosis or error in treatment
- A drop in clinical staff productivity
- A drop in patient satisfaction scores

The Project

Our mission, simply put, is to identify and explore the use of new benchmarks that better demonstrate the *value CE has on the delivery of patient care*. Perhaps over time, we can influence the behavior of CE program managers by switching the focus of our benchmarking efforts to include metrics actually important to those responsible for delivery of care. Lastly, via this process, we hope to provide guidance to the CE community on how they can (and should) raise the visibility and importance of having a properly supported, funded, and staffed CE program, by quantifying the impact the department has on the delivery of patient care.

In order to test these assumptions—the need for, and use of new CE benchmarks—we agreed to participate in a project which would consist of three phases:

- Phase I: Test the assumptions of what's important to clinical staff by asking clinical department managers a simple question: Concerning CE's support of patient care technology, what's important to you and your staff, and what is the impact of device failure on your work?
- Phase II: Collect initial data by using a manual

process whereby our biomedical technicians would ask equipment users what the impact was of the device failure. Identify problems with data collection, and determine what data elements can be easily collected.

- Phase III: Analyze initial data and develop recommendations based on our findings to include assessments related to ease of data collection; how to collect the data; how the data can be used to further develop the CE program; and recommendations to the CMMS vendors on changes they need to make to their software to support future data collection and analysis plans.

Participants in this study included personnel from Aurora Health Care in Milwaukee, WI, Scripps Health in San Diego, CA, and McLaren Health Care in Flint, MI.

Phase I: Validating What's Important

First, we had to speak to the clinical users to validate our hypothesis that our new non-traditional metrics are indeed important to them. We conducted individual interviews with clinicians in various departments in the hospital. We met with 42 nurses, managers, and technicians and asked them a series of questions. We queried a cross section of departments, including critical care, lab, imaging, surgery, and general patient floors. Our questions focused on three areas: the impact of device failures on patients, their impact on staff, and the impact CE has in minimizing potential negative outcomes.

Most respondents, 95%, said a CE department could have the biggest impact on patients by preventing a delay in care. Also scoring 95% on the impact scale was the effect CE has on clinical staff job satisfaction and productivity. Additionally, 83% agreed that CE impacts the outcome of a device failure because CE staff can resolve the problem in real time, allowing the procedure to proceed as planned. We were humbled, but not surprised, that we have not been measuring the things important to our customers. Figure 1 summarizes the findings from our survey of clinicians.

Our interviews gave us some insight into the difficulties faced by our staff when equipment doesn't work and patient satisfaction suffers. When asked for examples of device failures affecting patient satisfaction, respondents mentioned beeping IV pumps, PCA pumps that don't work, and any device failure causing a case to be cancelled or rescheduled. They get nervous when devices have to be swapped out, due to suspected malfunction.

Patient impact	Satisfaction	90%
	Delay in care/treatment/test	95%
	Extended hospital stay	67%
	Injury/death	83%
	Increased safety risk	86%
	Delay or error in diagnosis	81%
Staff impact	Job satisfaction	95%
	Productivity/effectiveness	95%
CE impact	Hero! Can proceed as planned	83%
	Can't proceed/must change equipment	67%

Figure 1. Percentage of Respondents Who Agree That CE's Handling of Device Failures Is Important in These Categories

The imaging and lab departments were identified as the ones where CE can most strongly impact patient satisfaction.

Further questioning revealed:

- Overhead lights, telemetry, IV pumps, and anything requiring a patient to be moved during a case had the biggest impact.
- Two thirds of respondents said big contributors to extending hospital stay are the outcome of equipment failures and the performance of equipment in the lab.
- Imaging and general patient floors reported being the least affected by failures that extend hospital stay.
- The most severe impact to the patient is obviously a failure causing injury or death. Eighty-three percent of the clinicians surveyed said that equipment failure resulting in injury or death is a valuable metric. The intensive care units (ICU) and surgery, in particular, reported failures of equipment in their areas that could result in injury or death.

- The vast majority, 86%, of clinicians we spoke to said CE activities can impact patient safety. Examples of devices where failures could imperil safety include patient beds, surveillance cameras, and sterilizers. Surprisingly, life support devices were not high on the list—another sacred cow?

Device failures affect clinical staff in a profound way. Frustration, anxiety, and lost productivity are realities for staff who can't find equipment or can't find working equipment. Time spent looking for working equipment leads to dissatisfaction and higher cost. Ninety-five percent of respondents felt CE departments directly affect staff satisfaction through their ability to impact equipment reliability and availability.

Clinicians were asked about the impact CE has when responding to stat calls, the frantic “the-patient’s-on-the-table” type of situation. These high-stakes calls offer the opportunity for a technician to save the day, whether it’s negating the need to cancel a procedure or reducing the risk of injury to a patient. The percentage of times CE can be the hero on a stat call is an important indicator and one that can and should be measured. To our surprise, none of the CMMS products our three groups currently use have the ability to easily track or quantify this simple but important metric.

After we queried our clinicians about the impacts the CE department can have on patients and staff, we asked whether we should even collect this data. All agreed that we should collect this data, but opinions varied on which events should trigger the collection. Some respondents believe we should collect this data after every failure, some believe we should only collect it for user error, negative patient outcome, or long down times. Some suggested we should develop a severity ranking and collect this data for only the severe events. Suggestions on how

		Increased Proc. Time	Increased Diag. Time	Increased Stay	Increased Injury Risk	Increased Safety Risk	Decreased Productivity	Patient Complaint
Sys #1	Percent Yes	40.15%	23.23%	15.91%	1.26%	14.14%	56.06%	2.02%
Sys #2	Percent Yes	25.51%	4.08%	2.04%	0.00%	30.61%	58.16%	72.45%
Sys #3	Percent Yes	71.43%	2.38%	2.38%	0.00%	4.76%	45.24%	59.52%
Combined	Percent Yes	39.93%	18.10%	12.31%	0.93%	16.42%	55.60%	19.40%

Table 1. Response to the Question: Did the Device Failure Result In . . . ?

to collect the data varied, from using occurrence report forms and patient satisfaction survey data, to conducting follow-up interviews with supervisors, to using rounds, self-assessments, annual surveys, and questionnaires.

Phase II: Data Collection

Now that we had confirmed with our clinical customers this was a worthwhile endeavor, we set about collecting the data. We asked our techs to complete questionnaires on every service event for one month. Given the size of our respective organizations, we believed there would be enough data collected in that timeframe to make the resulting analysis statistically significant and relevant. Indeed, we also recognized there would be challenges/limitations in the data collection process. For example, the target caregiver experiencing the equipment failure might not know if there would be an extended stay, a complaint generated, or an impact on productivity. Also, it might not be the person experiencing the issue who places the call to CE. Nonetheless, we expressed to our team the importance of this information and how it could help us and asked them to do their best without becoming overly intrusive. We also recognized the need to proactively communicate the process with clinical leadership and gain their support in advance.

Once the data collection process began, all questionnaires were sent to one individual to aggregate. We received more than 500 responses on specific service events. The results from each organization were then combined for overall analysis.

Phase III: Data Analysis

Table 1 shows the results by percentage of “yes” responses to each of the category questions asked.

The data revealed some interesting differences and similarities between the three organizations. Drilling into the data, we determined the differences to be mostly related to the number of certain device types included in the mix. For example, System #3 data showed a much higher percentage of increased procedure time, which corresponded to a higher number of lab devices in its overall number of responses. Similarly, System #1’s data showed a much higher percentage of both increased diagnosis time and increased stay, which corresponded to a higher mix of imaging devices in its overall responses, and System #2’s data showed a higher percentage of increased safety risk, corresponding to a higher mix of anesthesia machines.

It was difficult to discern the reason for the large disparity in patient complaint numbers, whether folks

Impact by Device (Combined Sites)														
Decreased Productivity		Y	Increased Proc. Time		Y	Fixed Immediate		Y	Patient Complaint		Y	Increased Diag. Time		Y
Count of Decreased Productivity			Count of Increased Proc. Time			Count of Fixed Immediate			Count of Patient Complaint			Count of Increased Diag. Time		
Device	Total		Device	Total		Device	Total		Device	Total		Device	Total	
Scanning System, Ultrasonic	17		Radiotherapy System, Linear Accelerator	17		Scanning System, Ultrasonic	19		Monitor	13		Scanning System, Ultrasonic	10	
Radiographic System	16		Scanning System, Magnetic Resonance Imaging	14		Monitor	12		Anesthesia Unit	6		Monitor, Bedside, Physiologic	7	
Radiotherapy System, Linear Accelerator	15		Monitor, Bedside, Physiologic	13		Camera, Gamma	10		Analyzer, Laboratory, Urine	6		Scanning System, Computed Tomography	6	
Monitor, Bedside, Physiologic	14		Scanning System, Ultrasonic	10		Radiotherapy System, Linear Accelerator	9		Monitor, Bedside, Physiologic	5		Radiotherapy System, Linear Accelerator	6	
Scanning System, Magnetic Resonance Imaging	13		Radiographic System	10		Scanning System, Magnetic Resonance Imaging	7		Warming/Cooling Unit, Patient	4		Scanning System, Magnetic Resonance Imaging	5	
Camera, Gamma	10		Scanning System, Computed Tomography	8		Monitor, Bedside, Physiologic	7		Table, Operating	4		Radiographic System	5	
Workstation, Digital Radiography, Imaging II	9		Electrocardiograph	7		Analyzer, Laboratory, Clinical Chemistry	6		Camera, Video, Endoscope	4		Camera, Gamma	4	
Electrocardiograph	9		Warming/Cooling Unit, Patient	6		Anesthesia Unit	6		Analyzer, Laboratory, Clinical Chemistry	4		Radiographic System, Digital, Mammographic	3	
Sterilizing Unit, Liquid	8		Camera, Gamma	6		Scanning System, Computed Tomography	6		Ventilator, Intensive Care	3		Probe, Ultrasonic	3	
Scanning System, Computed Tomography	7		Table, Operating	5		Radiographic/Fluoro Syst, Angiographic / Intervent	6		Sterilizing Unit, Steam	3		Electrocardiograph	3	

Table 2. Combined Top 10 Results of Impact by Device

employed at one system are just generally more understanding or apathetic, but we suspect it had a lot to do with how the questions were asked.

Overall, we saw a great deal of similarity among the three organizations. If you accounted for the imaging device mix at System #1, the increased diagnosis and increased stay numbers fell in line with the numbers represented by the other two organizations. The increased injury risk responses were extremely low or non-existent across the board and decreased productivity was high across the board.

So what conclusions can be drawn from the data?

Table 2 shows the combined top 10 results of “impact by device,” broken out by category and ordered by total number of responses, high to low. The middle column shows the device types most often fixed immediately. If you compare your top 10 impact device types with the top 10 “fixed immediately,” do they correspond? Are you applying your resources and “being a hero” in a way that matters most to your customers and patients?

According to our results we’re doing pretty well, but there are opportunities to do even better. This can also be a great tool to help justify in-house support for certain high-end imaging devices if you aren’t currently supporting them.

Conclusions and Next Steps

The preliminary results of our efforts were revealing and extremely valuable—and it is clear we need more data

BI&T Extra

To see the clinical engineering outcome metrics survey, along with examples of both a data collection form and a cover letter sent to nursing managers in connection with this project, visit www.aami.org/publications/BIT/.



and continuous data. We need to work closely with our CMMS vendors to develop a comprehensive survey tool to keep this data coming in without putting an undue burden on our staff or our clinical customers.

We need to develop tactics using the data collected to put our resources where they matter most to our organizations and the patients we serve. We need to apply the data to build device type-specific programs where they don’t currently exist and/or optimize the ones that do exist in a way that best supports our organizations and clinical customers.

We need to share the information with our administrative and clinical leadership to show them what we are doing or can do to provide better service and align ourselves with the business, mission, and goals of our organizations and promote CE’s value to them. Lastly, we need to share this concept with all in our profession and begin benchmarking these metrics with others. ■

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