

Get Your Checkup

ASQ study looks at hospital deployment of lean and Six Sigma



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by the ASQ Lean Six Sigma Hospital Study Advisory Committee

In 50 Words or Less:

- A recent ASQ survey looked at why hospitals are driven to pursue lean, Six Sigma or both.
- The study also examined deployment, targets and specific tools.
- The results offer a range of benchmarks and a first look at the possible future of healthcare improvement efforts.

For nearly 20 years, lean and Six Sigma improvement initiatives have been in the quality spotlight, helping thousands of organizations in the United States and elsewhere. But are hospitals across the United States truly embracing the lean and Six Sigma movement, and if so, are these efforts making a difference?

Lean is based on long-held practices advanced by the Toyota Motor Corp., with an emphasis on removing waste from organizations while focusing on and delivering more value to customers. Six Sigma focuses on variation reduction in processes, products and delivered services. Although both methods are applicable in a wide array of industries, they have received the most attention in manufacturing.

In the last decade, however, these two distinct improvement approaches have moved—independently or together—into many nonmanufacturing fields, such as service, insurance and financial businesses.

Healthcare professionals, too, have sought to apply the principles and tools of lean and Six Sigma in their organizations, with many examples and case studies of successes, such as Virginia Mason Hospital/Medical Center in Seattle, the Mayo Clinic in Rochester, MN, and Massachusetts General Hospital in Boston.

While anecdotal success stories provide promise and incentive to organizations considering these initiatives, there's been little substantive proof of the efficacy of these methods in healthcare institutions. Last year, ASQ attempted to identify the level of adoption of lean or Six Sigma practices at U.S. hospitals and, if possible, assess the correlation of these improvement initiatives with management, operational and financial performance.

The questionnaire

ASQ sent an online questionnaire to a list of hospitals and to ASQ members participating in the healthcare sector, with 77 hospitals responding. The questionnaire consisted of 31 questions, accounting for 246 variables.

Respondents to the "[ASQ Hospital Study](#)" were predominantly senior-level executives: 70% of responses came from titles of CEO, COO, CFO, VP, chief medical officer, chief quality officer or lean/Six Sigma leader.

The study attracted the attention of only a small percentage of the approximately 5,000 hospitals nationwide. It is, therefore, not surprising that the most basic of the study variables at full participation provide a confidence interval of approximately ± 11 at 95% confidence level. Subquestions related to those hospitals deploying only lean or Six Sigma are even less statistically significant.

Nonetheless, all study analysis provides a range of benchmarks that have been lacking to date for hospitals considering lean or Six Sigma.

Deployment

Many U.S. hospitals are now keenly aware of the need for improvements in core processes and are deploying lean and Six Sigma to address this need: 53% of study hospitals report some level of adoption of lean, 42% some level of adoption of Six Sigma and 37% some level adoption of the hybrid approach of lean Six Sigma.¹

Study hospitals that have deployed lean, Six Sigma or both cite the following as the most frequent criteria for targeting an area or areas of their facilities for improvement:²

- **Lean:** Throughput need (73% of hospitals), business or cost need (68%) and quality need (56%).
- **Six Sigma:** Business or cost need (69%), quality need (62%) and throughput need (41%).

Among the study hospitals where deployment has not begun, it's generally not for lack of interest or belief in the concepts. Of the nondeployers of lean, Six Sigma or lean Six Sigma, none indicated that they don't need it or don't believe it works, and only 11% of respondents indicated they didn't know what these methods were.³

Respondents indicated the chief reasons for nondeployment are lack of resources (59%), not enough information to deploy (41%), lack of buy-in from leadership (30%) and lack of deployment talent (22%). Other reasons not listed are cited by 26%.⁴

The survey's deployment findings should be encouraging to those looking for ways to change how their hospitals operate. The findings indicated that a high percentage of healthcare facilities are beginning to use these tools and concepts. But "beginning" is the operative word. For example, although 53% of study hospitals reported they have deployed lean, 44% identify deployment as minor, 4% as moderate and 4% as full. The other approaches were similarly limited in effort (see Table 1).

Hospital deployment / TABLE 1

	Lean	Six Sigma	Lean Six Sigma
No deployment	47.2%	57.5%	62.9%
Minor deployment	44.4%	26%	27.1%
Moderate deployment	4.2%	8.2%	4.3%
Full deployment	4.2%	8.2%	5.7%

Minor deployment efforts usually occur in one of two ways within organizations:

1. One or two departments apply a palette of improvement tools to upgrade performance (frequently referred to as creating islands of excellence in an organization). Often, these efforts fail to impact overall hospital performance and are difficult to sustain without the momentum of a wider, deeper effort within the organization.
2. There is focus on only minor areas (such as housekeeping) or minor tools (such as visual management) and on attacking low-hanging and often low-impact fruit within the organization.

It can be argued, however, that even minor deployment is necessary to gain any type of improvement foothold. And starting—where, how and with whom—can be the most challenging aspect of improvement, frequently followed by an ability to sustain improvements.

The inability to sustain improvement was cited by 68% of study hospitals as the greatest challenge to achieving successful lean deployment and by 53% of hospitals as the greatest challenge to achieving successful Six Sigma deployment (see Table 2). Other challenges include competition from other initiatives, level of leadership commitment and availability of resources.⁵

Greatest challenges to successful deployment / TABLE 2

	Lean	Six Sigma
Sustaining improvements	68.3%	52.6%
Competition from other initiatives	58.5%	47.4%
Leadership commitment	53.7%	52.6%
Availability of resources	51.2%	55.3%
Building employee knowledge	34.2%	42.1%
Motivating employees	31.7%	39.5%
Expertise	22%	26.3%
Scaling up the effort	14.6%	29%
Other	2.4%	2.6%
No challenges	0%	2.6%

Targets and success

The study sought to identify the locations or departments in hospitals that are most frequently targeted for deployment of lean or Six Sigma initiatives. The study asked respondents to identify whether lean or Six Sigma had been deployed in an area and to report on the general rate of success with the deployment.

The sample size of hospitals responding to these questions was relatively small—about 30 to 40 hospitals for the deployment portion, with many of those responders indicating that the success rate portion of the question was not applicable, thus further reducing the number of hospitals that indicated success. So, while these data are not statistically significant, they nonetheless provide insight into popular deployment targets among the study sample.

Based on the responses, departments within clinical areas of study hospitals are more likely to be selected for lean deployments than ancillary services or nonclinical support services. This isn't surprising because throughput and quality

are typical objectives for lean deployments and are core to hospitals' successes or failures.

But consider: Because nonclinical areas actually resemble the processes targeted by traditional lean deployments in other industries, it's surprising that more isn't being done in these areas—especially given the large number of case studies and benchmarks offering guidelines for successful implementation.

Hospitals were asked to indicate the state of lean deployment for each area and to indicate the general rate of success of those distinct efforts (see Table 3).

Targets and success rates for lean deployments with hospitals were:

- **Clinical:** The most popular targets for lean deployment in clinical areas were operating rooms (61% of hospitals), emergency (60%), and in-patient areas, not including mental health, rehabilitation or intensive care units (53%). The highest percentages of success (combined percentages for somewhat successful or highly successful) were found in operating rooms (95% of hospitals that indicated lean success there), outpatient and ambulatory (95%) and emergency (86%).
- **Ancillary and support services:** The most popular targets in ancillary services for lean deployment were admissions and discharge (43% of hospitals), and radiology and imaging (43%). The highest percentages of success were admissions and discharge (94% of hospitals that indicated lean success there), sterilizing and reprocessing (89%), and radiology and imaging (87%).
- **Nonclinical support:** The most popular targets for lean deployment in nonclinical areas were purchasing (36% of hospitals), information systems (24%) and administration (24%). The highest percentages of success were found in information systems (89% of hospitals indicated lean success there) and administration (87%).

Lean deployment locations and successes / TABLE 3

	Deployed in area	Not successful	Somewhat successful	Highly successful	
Clinical	Surgery and operating room	60.5%	5%	75%	20%
	Emergency	60%	13.6%	77.3%	9.1%
	In-patient (not mental health, rehabilitation or intensive care unit)	52.8%	15.8%	78.9%	5.3%
	Outpatient and ambulatory (not mental health or rehabilitation)	50%	5%	75%	20%
	In-patient intensive or critical care	28.6%	16.7%	75%	8.3%
	Home health	16.7%	14.3%	71.4%	14.3%
	Rehabilitation	11.8%	33.4%	66.7%	0%
	Mental health	11.1%	25%	75%	0%
Ancillary and support services	Admissions and discharge	42.9%	5.6%	77.8%	16.7%
	Radiology and imaging	42.9%	12.5%	68.7%	18.8%
	Pharmacy and pharmaceutical services	28.6%	30.8%	53.9%	15.4%
	Sterilizing and reprocessing	27.8%	11.1%	77.8%	11.1%
	Patient transportation	19.5%	20%	70%	10%
Nonclinical/support	Purchasing and supply	36.1%	21.4%	64.3%	14.3%
	Information systems	24.3%	11.1%	77.8%	11.1%
	Administration	24.3%	12.5%	37.5%	50%
	Accounting	19.5%	25%	50%	25%
	Maintenance	11.4%	16.7%	83.3%	0%
	Other	57.1%	0%	71.4%	28.6%

Note: Deployment percentage subtracts from 100% of the hospitals that answered "not applicable: department or function does not exist at this hospital," "no deployment or projects underway" and "deployment not underway, but planned." Success-rate percentages are prorated based on the hospitals indicating success and excluding "not applicable: department does not exist or deployment not underway."

Departments within clinical areas of hospitals were more likely to be targeted for Six Sigma deployments than ancillary services or nonclinical support services. Hospitals were asked to indicate the state of Six Sigma deployment for each area and the general rate of success of those distinct efforts (see Table 4).

Six Sigma deployment locations and successes / TABLE 4

		Deployed in area	Not successful	Somewhat successful	Highly successful
Clinical	Emergency	71.9%	12.5%	66.7%	20.8%
	Surgery and operating room	65.6%	4.5%	81.8%	13.6%
	In-patient (not mental health, rehabilitation or intensive care units)	59.4%	5%	80%	15%
	In-patient intensive and critical care	39.4%	14.3%	57.1%	28.6%
	Outpatient and ambulatory (not mental health or rehabilitation)	53.1%	10.5%	73.7%	15.8%
	Home health	25%	22.2%	44.4%	33.3%
	Mental health	18.2%	16.7%	50%	33.4%
	Rehabilitation	15.6%	28.6%	42.9%	28.6%
Ancillary and support services	Admissions and discharge	56.3%	10%	80%	10%
	Radiology and imaging	53.1%	11.1%	50%	38.9%
	Pharmacy and pharmaceutical services	50%	11.8%	64.7%	23.5%
	Sterilizing and reprocessing	21.9%	12.5%	62.5%	25%
	Patient transportation	25%	20%	50%	30%
	Other	57.1%	0%	71.4%	28.6%
Nonclinical support	Purchasing and supply	53.1%	12.5%	62.5%	25%
	Information systems	24.2%	9.1%	72.7%	18.2%
	Maintenance	21.9%	11.1%	66.7%	22.2%
	Administration	15.6%	0%	50%	50%
	Accounting	15.2%	14.3%	42.9%	42.9%
	Other	57.1%	0%	71.4%	28.6%

Note: Deployment percentage subtracts from 100% those hospitals that answered "not applicable: department or function does not exist at this hospital," "no deployment or projects underway" and "deployment not underway, but planned." Success-rate percentages are prorated based on the hospitals indicating success and excluding "not applicable: department does not exist or deployment not underway."

Targets and success rates for Six Sigma deployments with hospitals were:

- **Clinical:** The most popular targets for Six Sigma deployment in clinical areas were emergency (72% of hospitals), surgery or operating rooms (66%) and in-patient areas, not including mental health, rehabilitation or intensive care units (59%). The highest percentages of success were found in operating rooms (95% of hospitals indicated Six Sigma success there) and in-patient areas, not including mental health, rehab or intensive care units (95%).
- **Ancillary and support services:** The most popular targets for Six Sigma deployment in ancillary services were admission and discharge (56% of hospitals), radiology and imaging (53%) and pharmacy and pharmaceutical services (50%). The highest percentages of success were admissions and discharge (90% of hospitals indicated Six Sigma success there), radiology and imaging (89%) and pharmacy and pharmaceutical services (88%).
- **Nonclinical support:** The most popular targets for Six Sigma deployment in nonclinical areas were purchasing (53% of hospitals), information systems (24%) and maintenance (22%). The highest percentage of success (combined percentages for somewhat successful or highly successful) were found in administration (100% of hospitals indicated Six Sigma success there) and information systems (91% of hospitals).

Half (median 50%) of lean deployments cut across hospital departments and, similarly, 50% (median) of Six Sigma deployments cut across hospital departments.⁶

In addition to deployment by location, those who participated in the study were asked to identify what areas of improvement hospitals were targeting when they deployed lean and Six Sigma hospitalwide. For lean, the highest percentages were turnaround time (63% of hospitals), productivity (59%), capacity use (49%), quality of care (46%) and staff use (46%).

The highest percentages for Six Sigma were turnaround time (63% of hospitals), productivity (56%), quality of care (54%), capacity use (51%) and staff use (44%).⁷

A majority of hospitals have applied the following specific lean and Six Sigma tools in their organizations:⁸

- Value-stream mapping (84%).
- 5S (80%).
- Failure mode effects analysis (80%).
- Define, measure, analyze, improve and control (75%).
- Pareto analysis (73%).
- Statistical process control and control charts (73%).
- Project charters (71%).
- Plan-do-check-act/adjust (59%).
- Five whys (55%).
- Seven or eight wastes elimination (55%).
- Visual management or organization (55%).

The figures on deployment (locations, criteria and specific tools) highlight significant lean and Six Sigma activity within many hospitals. What we found sobering were the findings indicating the cost of lean and Six Sigma at study hospitals deploying the initiatives in 2007: \$25,000 (median) for lean and \$96,485 (median) for Six Sigma.⁹

While lean has always been heralded as a low-cost improvement activity, the lean and Six Sigma investment figures were surprisingly low for the size of these healthcare facilities (see the survey demographics in Table 5).

Respondent demographics / TABLE 5

Is this hospital for-profit or nonprofit?	For-profit	5.2%
	Nonprofit	94.8%
Is this hospital independent or part of a hospital system?	Independent	49.4%
	System	50.7%
If part of a hospital system, how many hospitals are in the system?	Median	11
	Average	23
Is this a teaching hospital?	Yes	23.7%
	No	76.3%
What was your hospital's approximate gross revenue in 2007?	Less than \$25 million	8.3%
	\$25 million to \$100 million	23.6%
	\$101 million to \$250 million	23.6%
	\$251 million to \$500 million	29.2%
	\$501 million to \$1 billion	11.1%
	More than \$1 billion	4.2%
How many staffed beds?	Median	161
	Average	231
How many hospital admissions in 2007?	Median	8,402
	Average	11,441
How many total hospital days of patient care in 2007?	Median	38,691
	Average	59,936
What is your hospital's payer mix (based on average responses to each payer group)?	Private payers	28.2%
	Government payers	59.5%
	Self-pay	6.5%
	Other	5.9%
Please report hospital staffing levels for 2007 (based on average responses for each position).	Staff physicians, medical scientists and research associates	204
	Residents, fellows and students	20
	Administration and support personnel	774
	Other staff	867
	Total staff	1,865
What is the approximate age of the majority of your physical plant?	Median	30
	Average	28.5

Impact

Correlating lean and Six Sigma deployments of hospitalwide improvement projects is hardly a straightforward exercise. Correlation is complicated by a variety of factors in the study data and the hospitals responding to the study:

- A relatively small percentage of deployment with any one improvement initiative and, thus, small beginning samples for cross-tabulations of data.
- Even smaller percentages of moderate or full deployment with any one improvement initiative, where strong correlations with improved performance would be expected.
- A high percentage of hospitals, especially those without lean or Six Sigma deployments, that don't track many relatively common operational metrics (length of stay and patient complaints, for example) and financial metrics (cost per patient and total asset turnover, for example) that appeared on the study.

Given these considerations, it's not surprising the correlation between deployment of improvement methods within study hospitals and improved operational and financial performance appeared equivocal.¹⁰

Based on those findings from a small sample, it would also be easy to question whether lean and Six Sigma have real, broad impact across hospitals nationwide, rather than just in isolated departments, or any ability to close the gap between good and bad metrics.

Yet, based on the success of these methods in other industries and on an increasing number of anecdotal hospital case studies, the real questions may be:

- What would the results be if hospitals deployed lean and Six Sigma at deeper and broader levels and for longer periods?
- What would the real results be if hospitals, especially those without lean or Six Sigma deployments, tracked the common operational and financial metrics that appeared on the study?
- How would hospitals without lean or Six Sigma deployments compare with those hospitals that did deploy the methods?
- What if other hospitals—those oblivious to lean or Six Sigma, or those that had the need for improvement in general—had participated in the study?

The "ASQ Hospital Study" provides an intriguing first look at a more efficient healthcare future. It suggests the next step toward improvement for most hospitals is a broader deployment of lean and Six Sigma and rigorous tracking of their results.

Notes

1. Three separate questions were used to assess the deployment levels of the three improvement methods, with respondents able to select "no deployment," "minor deployment," "moderate deployment" and "full deployment."
2. Hospitals were presented an array of criteria and allowed to select more than one response.
3. Hospitals could select one or more responses from an array of factors.
4. Hospitals could select one or more responses from an array of factors.
5. Hospitals could select one or more responses from an array of factors.
6. Hospitals were asked, separately pertaining to lean and Six Sigma, what percentage of their deployments and projects cut across hospital departments.

7. Hospitals could select one or more responses from an array of criteria.
8. Hospitals could select one or more responses from an array of tools.
9. For lean and Six Sigma spending, one respondent indicated \$0 on the deployments.
10. Data are available in the "[ASQ Hospital Study](#)."

Editor's note

This article was prepared by the ASQ Lean Six Sigma Hospital Study Advisory Committee, which included ASQ members and subject matter experts. Results of the survey were compiled by a partnership of two independent research organizations, the MPI Group and Industry Insights, which also assisted ASQ in designing the study. The complete study, "ASQ Hospital Study Data Report," is available on this article's page.

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