Are Hospital Quality Characteristics Consistent Over Time?

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We conduct a study of a large sample collected from hospitals to extend the knowledge of quality indicators in the healthcare profession and to determine if results are consistent over time. Findings show that, over time, the hospital size and teaching status were consistent indicators of higher rates of error as shown by several patient safety variables. This is contrary to conventional wisdom, which holds that the best care is provided by large teaching hospitals. As a result, context variables are shown to influence quality indicators in a healthcare setting that could also offer implications for quality in other industries.

Keywords: quality indicators, organizational context, hospital quality

INTRODUCTION

Quality management theory has been researched and documented for decades beginning with the earliest quality pioneers (Crosby, 1979; Deming, 1986; Juran, 1986) and refined through the additional consideration of organizational context based on contingency theory (Benson, et al., 1991, Spencer, 1994; Powell, 1995). Contingency theory has further been employed by quality researchers to examine the relationship between a wide range of variables from traditional business areas such as strategy (Ho, 2015; Pertusa-Ortega, Molina-Azorin, and Claver-Cortes, 2010), to more current fields such as lean six sigma (Sousa and Voss, 2001; Wang, et al., 2020), but also in the service sectors of health care and humanitarian organizations (Cornforth, 2002; Mohammad, Carrasco-Gallego, and Ronchi, 2019). Given that quality has been generally accepted as an important principle and is contingent on many variables unique to specific organizations, the question arises over whether quality is consistent over time. This curiosity combined with the importance of health care as exhibited through the recent worldwide pandemic begs the research question of whether the safety of patients in hospitals can be shown to be consistent over time.

The Center for Disease Control reported in the last 21 months from March 2020 up to 176 hospital beds per day per 100,000 US population have been occupied by Coronavirus Disease 2019 (COVID-19) patients (COVID-NET, 2022) alone, and the University of Minnesota COVID-19 Hospitalization Tracking Project showed there were over 125,000 patients admitted to hospitals across the nation at the beginning of 2021 (COVID-19 Hospitalization Tracking Project, 2022). These numbers are of course in addition to the normal hospitalization cases prior to the influx of COVID-19 patients. The quality of healthcare continues to be an uppermost concern due to the uniqueness of outcomes.

Quality in many industries is interpreted by the degree to which features or characteristics meet established criteria or customers' assessment of a product or service. Rarely does the lack of quality in most products or services lead to human fatalities; however, that is exactly the potential outcome when there is a lack of quality in the healthcare field. The Institute of Medicine's (IOM) 1999 seminal report "To Err is Human: Building a Safer Health System" estimated that there were between 44,000 and 98,000 preventable deaths every year due to medical errors (Institute of Medicine and Committee on Quality of Health Care in America, 2001). Subsequent reports by the IOM reinforced this specter of preventable death. While this is not the only quality indicator for the healthcare profession, patient safety certainly must be of paramount concern. With research indicating that contextual characteristics significantly influence the quality of healthcare provided in hospitals and patients' safety (Miller, et al., 2018), the question remains whether hospital patient safety is consistent over time.

METHODS

The study of contextual variables in an organization is a method of distinguishing aspects of quality that are unique to a particular industry. In general, context refers to variables such as size, ownership, environment, and technology (Conner, 1992); however, the healthcare industry has the unique ability to measure quality from the perspective of patient safety.

Patient safety indicators (PSI) is a unique set of data compiled as part of the Healthcare Cost and Utilization Project (HCUP) by the Agency for Healthcare Research and Quality. HCUP is an expansive database that gathers data from up to 97% of all community hospitals in the US. The PSIs were designed to aid in quality improvements through the early identification of potential in-patient safety problems (Miller, et al., 2001), such as obstetric trauma with instrument—i.e., the use of forceps during childbirth—and failure to rescue—i.e., delays in recognizing and/or responding to a complication during a medical procedure.

Following Miller et al., (2018), we collected a sample of 673 hospitals from an HCUP dataset using the same 20 PSIs, and used factor analysis to group the PSIs into seven categories:

1. Procedure complications
2. Mortality and disability
3. Postoperative care
4. Surgical complications
5. Postoperative falls
6. Trauma during delivery
7. Birth trauma and cesarean section

Based on scores in these seven categories, hospitals were placed in one of five quality performance groups. Each of the five groups were approximately the same size and the hospitals with the lowest average score across the seven categories ranked the highest in performance quality, i.e. they had the lowest rate of PSIs or incidences of adverse events. The hospitals at the other end of the spectrum with the highest scores indicated the highest rate of PSIs or adverse events and would display the lowest quality.

Similarly, we set up this study to measure nine context variables using six aspects of hospital context:

1. Hospital size (number of beds)
2. Teaching status
    a. Affiliation with a medical school
    b. Presence of a residency program

    c. Membership in the Council of Teaching Hospitals
3. Patient mix
    a. Percentage of patients with Medicaid
    b. Percentage of patients with Medicare
4. Rural status
5. Joint Commission on Accreditation of Healthcare Organizations (JCAHO) accreditation status
6. Type of ownership (nonprofit or for profit)

FINDINGS

This study applies a Chi-square analysis to determine whether there is a statistically significant relationship between any of the nine context variables and a hospital's placement in the five quality performance groups. Findings (see Tables 1-3) are consistent with those of the (Miller, et al., 2018), except we found hospital location (rural/not rural) and proportion of Medicaid patients not significant. Therefore, this study finds five statistically significant context variables: hospital size in number of beds, teaching status—i.e., affiliation with a medical school—, teaching status—i.e., presence of a residency program—, teaching status—i.e., membership in the Council of Teaching Hospitals—, and patient mix—i.e., percentage of patients with Medicare. We find the context variable patient mix—i.e., percentage of patients with Medicaid—marginally significant and the remaining two context variables, JCAHO accreditation status and type of ownership, not statistically significant.

The observed frequencies of the statistically significant context variables were examined for the best and worst-performing groups and then were compared to what would be expected if there was no relationship between performance and context variables. The results reported were:

+ Smaller hospitals were likely to perform better than larger hospitals
+ Non-teaching hospitals typically performed better than teaching hospitals
+ Rural hospitals typically performed better than non-rural hospitals
+ Hospitals with lower proportions of Medicaid patients and higher proportions of Medicare patients typically performed better than hospitals with opposite proportions (Miller, et al., 2018)

However, the results should be interpreted with care as there is potential for confounding variables or latent constructs. As an example, visual examination of the distribution in Table 1 for hospital size indicates hospitals with 100-199 beds are associated with relatively higher performance quality compared to hospitals with both a larger number of beds as well as a smaller number of beds. This might imply the liability of smallness and resource scarcity to smaller hospitals, or inefficient management and distraction in larger hospitals. Additionally, lower quality in larger hospitals might have been driven disproportionately by a larger number of visiting patients, or more patients with complex medical conditions needing complicated treatments. The same reasoning can apply to explaining why the location variable turned nonsignificant in this study; whereas, significant in the previous one.

TABLE 1
CHI-SQUARE RESULTS FOR SIZE AND TEACHING STATUS

	Hospital group*					Total
	1	**2**	**3**	**4**	**5**	
Bed size						
Under 100	32	17	7	3	2	61
100-199	50	45	38	33	18	184
200-299	30	35	33	24	25	147
300-399	15	20	26	30	33	124
400-499	5	14	11	10	19	59
Over 500	5	13	12	32	36	98
Total	137	144	127	132	133	673
Pearson Chi-Square = 125.26, degrees of freedom = 20, p-value = 0						
Medical school						
Yes	24	47	46	64	78	259
No	113	97	81	68	55	414
Total	137	144	127	132	133	673
Pearson Chi-Square = 56.20, degrees of freedom = 4, p-value = 0						
Residency						
Yes	21	33	33	55	66	208
No	116	111	94	77	67	465
Total	137	144	127	132	133	673
Pearson Chi-Square = 50.29, degrees of freedom = 4, p-value = 0						
Teaching Council						
Yes	4	10	10	28	35	87
No	133	134	117	104	98	586
Total	137	144	127	132	133	673
Pearson Chi-Square = 48.88, degrees of freedom = 4, p-value = 0						

**Hospital groups are ranked on a scale of 1-5, with 1 = best performance and 5 = worst performance*

TABLE 2
CHI-SQUARE RESULTS FOR LOCATION AND PATIENT MIX

	Hospital group					Total
	1	**2**	**3**	**4**	**5**	
Rural center						
Yes	9	9	10	5	3	36
No	128	135	117	127	130	637
Total	137	144	127	132	133	673
Pearson Chi-Square = 5.38, degrees of freedom = 4, p-value = 0.25						
Medicaid patient						
Low	39	54	44	47	40	224
Medium	56	41	48	39	41	225
High	42	49	35	46	52	224
Total	137	144	127	132	133	673
Pearson Chi-Square = 10.35, degrees of freedom = 8, p-value = 0.24						

Medicare patient						
Low	28	40	33	59	64	224
Medium	49	43	54	40	39	225
High	60	61	40	33	30	224
Total	137	144	127	132	133	673
Pearson Chi-Square = 44.62, degrees of freedom = 8, p-value = 0						

TABLE 3
CHI-SQUARE RESULTS FOR ACCREDITATION AND OWNERSHIP

	Hospital group					Total
	1	**2**	**3**	**4**	**5**	
JCAHO*						
Yes	124	128	112	122	122	608
No	13	16	15	10	11	65
Total	137	144	127	132	133	673
Pearson Chi-Square = 1.98, degrees of freedom = 4, p-value = 0.74						
Ownership						
Profit	25	24	15	14	16	94
Non-profit	112	120	112	118	117	579
Total	137	144	127	132	133	673
Pearson Chi-Square = 5.11, degrees of freedom = 4, p-value = 0.28						

**JCAHO = Joint Commission on Accreditation of Healthcare Organizations*

DISCUSSION

The findings emphasize the contingency nature of quality management by indicating that quality and contextual factors are interrelated. It implies managers need to tailor the quality control programs to the organizations' specific characteristics, and that managers need to focus on the quality management process as well as outcomes.

An important difference in these new findings is that while some of the contextual variables were not consistently significant (hospital location and proportion of Medicaid patients), measures of hospital size and teaching status continued to be significant. It is interesting to note that these two contextual variables continued to be significant in the findings even after seven years. This aids in the validity of the assertion that both hospital size and teaching status are reliable indicators of generally lower quality performance as indicated through a higher number of errors in patient safety variables. It is also interesting to note that while these findings are consistent with other studies (Romano et al., 2003; Rosen et al., 2006; Thornlow & Stukenborg, 2006; Vartak et al., 2008), they are contrary to conventional wisdom, which holds that the best care is provided by large teaching hospitals.

In terms of both size and teaching status, as noted in the previous study, it is possible that these results can be expected because large teaching hospitals typically have more complex cases than non-teaching hospitals, a fact not sufficiently accounted for by the risk adjustment method used for some of the PSI indicators. However, the results could indicate other quality issues. For example, the complexity of managing large hospitals with the attendant bureaucracy could have a negative influence on quality. Also, extremely complex bureaucracies at teaching hospitals, where teaching and learning are occurring for a wide range of symptoms for each patient, could potentially result in more errors.

Regardless of identifying the reasons for potential underlying causes, and since this study confirms errors are more likely to occur at large and at teaching hospitals, it is important that practitioner and quality managers at such hospitals devote greater attention to improving processes in order to eliminate errors,

profile internal processes, and benchmark other hospitals, including smaller hospitals and large hospitals with lower error rates. Managing quality at larger teaching hospitals may be inherently different than in smaller non-teaching hospitals.

CONCLUSION

Overall, the results of the study demonstrate that context variables can influence quality performance, and this can be especially critical for large and for teaching hospitals. The implication of these findings for hospital quality practitioners is that they should design processes to control quality better and to avoid patient safety errors. They also should consider how the characteristics of smaller and non-academic hospitals might impact quality outcomes. These results and findings were true in the initial study and still true today. However, with the influx of tens of thousands of Covid-19 patients requiring hospitalization, in addition to the healthcare systems normal hospital load, the consistency of these findings make them an even more critical concern to hospital quality practitioners.

Quality theorists and quality practitioners who focus on other industries should consider these findings and may identify other similar characteristics in other industries. This could lead to the development of additional theories and practices that will result in improving quality and eliminating errors.

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