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Relationship of Actual Response Time to Call Lights and Patient Satisfaction at 4 US Hospitals

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This multihospital study examined patient satisfaction with items of "received help as soon as possible" and "help to the bathroom" and their relationship to the actual response time to call lights. We found that faster actual response time to call lights contributed to higher patient satisfaction with "received help as soon as possible." The relationship between response time and patient satisfaction with "help to the bathroom" was not supported. **Key words:** *consumer satisfaction*, *hospital*, *patient*, *patient safety*, *quality of health care*

DELAYED response time to call lights is often assumed to be linked to patient dissatisfaction with nursing care, although this linkage is still inconclusive.[1-3] Patients tend to be less satisfied with the nursing care received during hospitalization if they also report dissatisfaction with call light responsiveness.[2] A recent study[3] examined the correlation between patient satisfaction at discharge and actual response time to call lights in a 32-bed surgical unit; however, no statistically significant relationship was found. Another study[1] conducted in 4 acute care units in one community hospital in Michigan revealed that delayed actual response time was associated with lower inpatient satisfaction with "received help as soon as possible" ($r = -0.30$, $P < .05$). However, no significant relationship was found between actual response time to call lights and inpatient satisfaction with "help to bathroom as soon as possible."

The survey study conducted by Senti and LeMire[2] in a Midwestern hospital birthing center concluded that patients demanded a quick response when they needed help. Also, response time to call lights was confirmed as 1 of the important factors in inpatient satisfaction. About 40% of the patients reported that they expected their calls to be answered within 4 minutes. Similarly, a multihospital survey study[4] found that as estimated by nurses, a patient's call was often answered within 4 minutes. The main reasons for call light use in acute inpatient care settings identified in previous studies[4-6] were consistent, including needing bathroom or personal assistance,

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intravenous problems/pump alarm, and pain medication and management. Toileting assistance was identified as the leading reason.[4] The multihospital survey study conducted by Tzeng and Yin[5] found that older female patients and family visitors were more satisfied with call light responsiveness if they perceived that nursing staff answered call lights in person more frequently, their problems were resolved more frequently after pushing the call light, and their call lights less often involved in safety concerns.

Another study[4] on the perspectives of staff nurses of the nature of patient-initiated call lights showed that 49% of staff perceived that these calls mattered to patient safety, and 77% agreed that patients' calls were meaningful or significant. Also, 53% thought that answering calls prevented them from doing critical aspects of their role. Staff's perceptions about the nature of calls varied across hospitals. Previous studies[4,5,7] suggested that front-line nurse managers should emphasize staff's responsiveness to call lights and their awareness of the importance of answering calls.

Call light tracking systems have been commonly adopted by the hospitals in the United States. However, hospital-archived, automatic-generated call light data have not been used regularly for quality improvement purposes (eg, improving patients' experience during hospitalization).[1] Multihospital studies are needed to systematically investigate the relational directions between actual response time to call lights and inpatient satisfaction scores.

PURPOSE OF THE STUDY

The purpose of this exploratory multihospital study was to examine patient satisfaction with items of "received help as soon as possible" and "help to the bathroom" and their relationship to actual response time to call lights in adult inpatient care units of 4 hospitals. We assumed that delayed response time to call lights would lead to patient dissatisfaction with the items of "received help as soon as possible" and "help to bathroom as soon as possible." The patient satisfaction items were included in the federally mandated, monthly inpatient satisfaction survey questionnaire in the Hospital Consumer Assessment of Healthcare Providers and Systems.[1,2] The importance of this study is to verify the use of actual response time to call lights generated from hospital-archived call light tracking systems in predicting inpatient satisfaction.

As an exploratory study, the covariates included the hospital, unit type, total nursing hours per patient-day (HPPD), percentage of the total nursing HPPD supplied by registered nurses (RNs), percentage of patients aged 65 years or older, average case mix index (CMI), percentage of patients with altered mental status, percentage of patients with hearing problems, time factor, and call light use rate per patient-day. In July 2007, the Centers for Medicare & Medicaid began to mandate that hospitals conduct Hospital Consumer Assessment of Healthcare Providers and Systems. Therefore, a time factor was included in this study as one of the covariates to indicate whether the data point was collected before July 2007 or collected in July 2007 and beyond. This study was developed on the basis of the Donabedian[8,9] framework of structure, process, and health care outcomes.

The patient care unit-month was the unit of analysis defined as data aggregated by month for each patient care unit. For example, the patient satisfaction score for unit A for January 2008 is the percentage of participants choosing "always" as the answer for that unit for the month. We analyzed data from 25 units in 4 Michigan hospitals using archived hospital data and reports collected during the period from March 2006 to May 2009 (varied by hospitals and study units because of the differences in data availability), for a total sample of 528 unit-month data points. The sample was the sum of the number of months with available data for each unit. Data were abstracted from the archived hospital data.

Two research hypotheses were tested. Research Hypothesis 1 was: Actual response time to call lights will contribute significantly

to predicting patient satisfaction with the item of "received help as soon as possible," after controlling for the covariates. Research Hypothesis 2 was: Actual response time to call lights will contribute significantly to predicting patient satisfaction with the item of "help to the bathroom," after controlling for the covariates.

METHODS

Design and settings

This exploratory study was conducted at 4 hospitals located in the Midwestern region in the United States using archived hospital data and reports. Twenty-five acute adult medical, surgical, and combined medicosurgical inpatient care units provided the data. Because of the differences across study hospitals in backing up archived data, the covered period of data varied for these hospitals to increase the total sample size. The descriptions of the study hospitals are: Hospital 1, academic medical center, bed size about 900, 12 participating units (March 2006–December 2008); Hospital 2, community hospital, bed size about 300, 4 participating units (February 2007–December 2008); Hospital 3, teaching hospital, bed size about 900, 4 participating units (April 2008–May 2009); and Hospital 4, teaching hospital, bed size about 700, 5 participating units (May 2006–December 2008).

The unit of analysis was the patient care unit-month (abbreviated as unit-month) defined as data aggregated by month for each patient care unit. The authors realized that some interdependence for the data points from a single unit and for the data points from the units from the same hospital existed. For statistical analyses and interpretation of the results, each data point for a study unit was assumed to be independent from each other. The study was approved by each hospital's institutional review board and the corresponding author's employer university.

Data sources, collection, and management

In each study hospital, a designated site coordinator was responsible for retrieving the archived hospital data and facilitating chart reviews. As for the 2 dependent variables, 2 Hospital Consumer Assessment of Healthcare Providers and Systems patient satisfaction items were identified: "During this hospital stay, after you pressed the call button, how often did you get help as soon as you wanted it?"; and "How often did you get help in getting to the bathroom or in using a bedpan as soon as you wanted?" These 2 items were measured on a 4-point Likert scale of always, usually, sometimes, and never. The aggregated scores were reported as a positive score (the percentage of "always" out of 100).

The predictor of average response time to call lights was retrieved from the reports generated from the call light tracking system adopted by each hospital. The average time for "staff response" was used, calculated as follows: (sum of the response time for the calls in seconds)/(total call light use). Because of the skewed distribution, this continuous variable was coded into 10 equal groups and labeled in percentiles (10 = fastest, 100 = slowest). The new variable was analyzed as a continuous variable.

A total of 10 covariates were included: the hospital, unit type, total nursing HPPD, percentage of the total nursing HPPD supplied by RNs, percentage of patients aged 65 years or older, average CMI, percentage of patients with altered mental status, percentage of patients with hearing problems, time factor, and call light use rate per patient-day.

As for the covariate of the hospital, 3 dummy variables were included in the regression model. Hospital 1 was used as a reference group; Hospital 2: 1 = Hospital 2, 0 = all other hospitals; Hospital 3: 1 = Hospital 3, 0 = all other hospitals; Hospital 4: 1 = Hospital 4, 0 = all other hospitals. As for the covariate of the unit type, 2 dummy variables were included in the regression model. Medical units were used as the reference group (unit type 2:

1 = surgical unit, 0 = all other units; and unit type 3: 1 = combined medical surgical unit, 0 = all other units).

Total nursing HPPD was defined as the number of productive hours worked by nursing staff with direct care responsibilities per patient-day, calculated as follows: total nursing hours/total patient-days.[10] The percentage of the total nursing HPPD supplied by RNs was defined as percentage of the number of productive nursing HPPD worked by RNs with direct care responsibilities to the number of total productive nursing HPPD worked by nursing staff with direct care responsibilities. It was calculated as follows: (total nursing HPPD supplied by RNs/total nursing HPPD) × 100%.[10]

The percentage of all patients discharged from the study unit during the defined time period, who were 65 years and older, was calculated as follows: (sum of the years of age of the discharged patients/total discharged patients) × 100%. The CMI value is used to define the average acuity for patients admitted to a particular hospital. The CMI value was calculated as follows: (sum of the CMI values of the discharged patients/total discharged patients) × 100%.[11]

Percentage of patients with altered mental status (quarterly data) was defined as the percentage of patients hospitalized at the study unit on the 15th of the first month of each quarter, who had cognitive impairment or altered mental status. The charts of a total of 10 randomly sampled patients per study unit were reviewed. If any cognitive impairment or altered mental status was identified in the chart at admission, this patient was coded as "Yes (1)," otherwise, "No (0)" was coded. This variable was calculated as follows: (number of patients with cognitive impairment or altered mental status/10) × 100%. Percentage of patients with hearing problem (quarterly data) was defined as the percentage of patients hospitalized at the study unit on the 15th of the first month of each quarter, who had hearing problems. The charts of a total of 10 randomly sampled patients per study unit were reviewed. If any hearing problems (with or without correction) were identified in the chart at admission, this patient was coded as "Yes (1)," otherwise "No (0)" was coded. This variable was calculated as follows: (number of patients with hearing problems/10) × 100%. As for the time factor, 1 dummy variable was included in the regression model: 0 = before July 2007, 1 = July 2007 and onward.

The variable of call light use rate per patient-day was calculated as follows: (counts of normal calls/number of the covered days) × (total number of days for the month)/(total patient-days for the month). The normal call count includes all the calls either cancelled at the console or at the stations of origin—the patient rooms. Because of the skewed distribution, this continuous variable was coded into 10 equal groups and labeled in percentiles (10 = least frequent, 100 = most frequent). The new variable was analyzed as a continuous variable.

All the data points were matched by the patient care unit as well as by the year and month. Only the unit-month data points with valid patient satisfaction scores (percentage of "always") with the item of "received help as soon as possible" (N = 528, 25 units, 4 hospitals) and with the item of "help to the bathroom" (N = 421, 21 units, 3 hospitals; no data available for hospital 3 were included in the data analysis. Since the distributions of the call light use rate per patient-day and actual response time to call lights were skewed and had more of the variance, both variables were coded into 10 equal groups for further analysis.

DATA ANALYSES

The Statistical Package for the Social Sciences (SPSS 18.0 Windows version; SPSS Inc, Chicago, Illinois) was used for data analyses. Separate hierarchical multiple regression analyses were used to test the 2 hypotheses. Missing values for the predictors were replaced by the mean values. The covariates were entered into the multiple regression equation first. Then, the average response time to call

lights was entered as a predictor into each model. Alpha was set at .05 for the analyses.

RESULTS

Descriptive information

A total of 528 data points (unit-month as the unit of analysis) were included in this study, including 295 (55.9%) data points from Hospital 1, 92 (17.4%) from Hospital 2, 51 (9.7%) from Hospital 3, and 90 (17%) from Hospital 4. A total of 256 (48.5%) data points were from medical units, 96 (18.2%) from surgical units, and 176 (33.3%) from combined medicosurgical units. A total of 160 (30.3%) data points were before July 2007 and 368 were in July 2007 or later. Table 1 shows the descriptive information of the study variables. The average patient satisfaction score with the item of "received help as soon as possible" (% of always) was 44.59% (44.59 of 100 total) (SD = 3.06), and the average patient satisfaction score with the item of "help to the bathroom" was 52.31% (SD = 34.74). The average actual response time to call lights was 16 minutes and 39 seconds.

Hypothesis testing

To test Research Hypothesis 1, hierarchical multiple regression was used to assess the ability of actual response time to call lights to predict patient satisfaction with the item of "received help as soon as possible," after controlling for the covariates. This analysis included a total of 528 data points from all 4 hospitals (25 units) and 14 predictors. All covariates were entered at step 1, explaining 4.1% of the variance in patient satisfaction with the item of "received help as soon as possible." After entry of actual response time to call lights at step 2, the total variance in patient satisfaction with the item of "received help as soon as possible" explained by the model as a whole was 6.3%, $F_{14,513} = 2.45$, $P = .002$. Actual response time to call lights explained an additional 2.2% of the variance in patient satisfaction with the item of "received help as soon as possible." In the final model, surgical unit ($\beta = .14$, $P = .02$), percentage of patients with altered mental status at admission ($\beta = -.12$, $P = .03$), percentage of patients with hearing problems ($\beta = .10$, $P = .04$), and actual response time to call lights ($\beta = -.17$, $P < .001$) were statistically significant.

To test Research Hypothesis 2, hierarchical multiple regression was used to assess the ability of actual response time to call lights to predict patient satisfaction with the item of "help to the bathroom," after controlling for the covariates. Because no data were available from Hospital 3 on patient satisfaction with the item of "help to the bathroom," this analysis included 421 data points (21 units) and a total of 13 predictors. All covariates were entered at step 1, explaining 4.9% of the variance in patient satisfaction with the item of "help to the bathroom." After entry of actual response time to call lights at step 2, the total variance in patient satisfaction with the item of "help to the bathroom" explained by the model as a whole was 5.1%, $F_{13,407} = 1.68$, $P = .06$. Actual response time to call lights explained an additional 0.2% of the variance in patient satisfaction with the item of "help to the bathroom." In the final model, Hospital 4 ($\beta = -.19$, $P = .03$), surgical unit ($\beta = .15$, $P = .02$), percentage of patients aged 65 years or older ($\beta = .23$, $P = .04$), and percentage of patients with altered mental status at admission ($\beta = -.13$, $P = .04$) were statistically significant. Actual response time to call lights ($\beta = -.05$, $P = .37$) was *not* statistically significant.

DISCUSSION

Discussions of hypothesis testing

On the basis of the findings, the first research hypothesis was supported, where faster actual response time to call lights by staff contributed to higher patient satisfaction with the item of "received help as soon as possible." Predictors of higher patient satisfaction with the item of "received help as soon as possible" were surgical units, a lower

percentage of patients with altered mental status at admission, a higher percentage of patients with hearing problems, and faster response time to call lights. Actual response time to call lights generated from hospital-archived call light tracking systems was confirmed to have the ability to predict patient satisfaction with the item of "received help as soon as possible."

In contrast, the second research hypothesis was *not* supported. Predictors of higher patient satisfaction with the item of "help to the bathroom" were Hospital 1 and Hospital 2, surgical units, having a higher percentage

Table 1. Descriptive Information of Study Variables by Hospitals[a]

Variable	Mean	SD	Minimum/Maximum
Dependent variables			
Patient satisfaction with item "received help as soon as possible" (% always; out of 100) (n = 528)	44.59%	27.56	0/100
Patient satisfaction with item "help to the bathroom" (% always; out of 100) (n = 421)	52.31%	34.74	0/100
Predictors			
Total productive nursing hours/patient-day	8.93	2.42	3.86/18.18
% of productive nursing hours provided by registered nurses	70.56	9.10	52.91/100
% of patients aged 65 years or older	39.71	15.77	10.34/81.04
Average case mix index value	1.73	0.72	0/4.32
% of patients with altered mental status at admission (unit-quarter)	11.86	13.81	0/70
% of patients with hearing difficulties at admission (unit-quarter)	10.84	11.16	0/50
Call light use rate per patient-day[b]	5.46	2.73	0/11.38
Patient call light use rate/patient-day (in 10 equal groups; 10 = least frequent, 100 = most frequent)[b]	47.20	24.84	10/1000
Response time to call lights[c]	16 min and 39 s	66 min and 22 s	34 s/976 min 28 s
Response time to call lights (in 10 equal groups; 10 = fastest, 100 = slowest)[c]	59.94	29.80	10/100

[a]The patient care unit-month was the unit of analysis defined as data aggregated by month for each patient care unit (unless specified). For example, the patient satisfaction score for Unit A for January 2008 is the percentage of participants choosing "always" for that unit for the month.
[b]The distribution of the patient call light use rate per patient-day was skewed. This continuous variable was coded into 10 equal groups.
[c]The distribution of response time to call lights (in seconds) was skewed. This continuous variable was coded into 10 equal groups.

of patients aged 65 years or older, and having a lower percentage of patients with altered mental status at admission. Actual response time to call lights did not predict patient satisfaction with the item of "help to the bathroom." This finding is consistent with an earlier study.[1]

Some common findings are apparent from testing the 2 research hypotheses. Total nursing HPPD, the percentage of the total nursing HPPD supplied by RNs, and time factor were not significant predictors of patient satisfaction with items of "received help as soon as possible" and "help to the bathroom." Staffing patterns did not have the ability to predict these 2 patient satisfaction items. Also, patients without altered mental status at admission tended to have more favorable ratings on staff's call light responsiveness.

We found that a higher percentage of patients with hearing problems led to higher patient satisfaction with the item "received help as soon as possible." It is possible that patients with hearing problems may receive additional attention and bedside assistance from nursing staff due to their sensory deficits. Nursing staff's accommodated behaviors may be 1 of the reasons that led to higher patient satisfaction with this item. Also, a higher percentage of patients aged 65 years or older led to higher patient satisfaction with the item of "help to the bathroom." It is possible that patients aged 65 years or older may have a greater appreciation of the toileting assistance they received during hospital stays. This may be 1 of the reasons for higher patient satisfaction with that item.

In short, on the basis of the Donabedian[8,9] framework of structure, process, and health care outcomes, actual response time to call light would be an objective, staff-centered indicator. Patient satisfaction with the item of "received help as soon as possible" would be a subjective, patient-centered outcome indicator. The present multihospital study confirmed the existence of the relationship between an objective, staff-centered indicator (actual response time to call lights) and a subjective, patient-centered outcome indicator (patient satisfaction) across adult acute inpatient medical, surgical, and combined medicosurgical care units from 4 hospitals. The findings of this study are encouraging and demonstrated 1 of the approaches for future nursing research with a focus on improving patient satisfaction.

Practical implications

Quality improvement interventions may be used to improve nurses' response time to call lights. If possible, hospitals should adopt call light systems that have the tracking and reporting capabilities to document staff's response time to call lights in a low-labor, systematic, and routine manner. Call light tracking and reporting capabilities are commonly available in the call light systems in the US market.[1] With call light tracking systems, front-line managers may monitor staff's response time to call lights on a daily, weekly, or monthly basis as needed, as well as by patients or staff members.

The nurse call light system should be used solely to signal staff members that a patient needs assistance. A different light or signal system may be needed for alarm notification of bedside patient monitors.[12] Adopting a user-friendly communication system to be used between patients and staff members as well as among staff members is also essential to promote the efficiency in answering call lights. Examples of systems include pagers, wireless phones, walkie-talkie–type devices, and message panels shown on work-on-wheel and desktop computers.

Study limitations

Having the patient care unit-month as the unit of analysis is recognized as a study limitation because some interdependence for the data points from a single unit and for the data points from the units from the same hospital existed. Two covariates were measured at the quarter level; the data measured quarterly

correlate highly from one month to the next as a study limitation. To increase sample size, this study included data points from different time periods across 4 study hospitals as another study limitation.

CONCLUSIONS

This study confirmed the ability to predict patient satisfaction with the item of "received help as soon as possible" based on actual response time to call lights at 4 US hospitals. It also confirmed what people have assumed—that faster response time to call lights leads to higher patient satisfaction with call light responsiveness in acute adult inpatient care settings.[1-3] A recent study[13] found that the higher the patient satisfaction scores with the item of "received help as soon as possible," the lower were the injurious fall rates; the hospital was the unit of analysis. The findings of this recent study[13] and the current study together suggest that it is possible that actual response time to call lights may predict the injurious fall rates as a direct effect and predict the injurious fall rates via patient satisfaction with the item of "received help as soon as possible" as an indirect effect on the fall rates. Additional research is needed to verify this relationship.

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