

Factors of Patient Satisfaction based on distant analysis in HCAHPS Databases

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ABSTRACT

HCAHPS patient survey data were analyzed to explore patient satisfaction factors by correlations and distance analyses by response size. Hospitals whose response size were 300 and over showed different factors of patient satisfaction from hospitals whose response size were smaller, which could be explained by hospital structure difference, such as hospital specialties. Correlations and distant analyses exhibited different results. Distant analyses have a potential to explore different aspects of patient satisfaction.

Keywords

Patient satisfaction, distant analysis, clustering, correspondence analysis, MDS, correlations

1. INTRODUCTION

Patient satisfaction has been considered to be a key factor to improve health care quality. The concept of patient satisfaction has been developed through the idea of customer satisfaction since 1950's. Framework of the quality of health care is consisted of three factors which are structure (ex. hospital buildings, healthcare system), process (ex. treatment, delivery of care) and outcome (ex. mortality rates, patient satisfaction) [5]. Two elements of the performance of practitioners are technical performance and Interpersonal performance [4].

Medical care as service, however, has different aspects from those of customer service in general; medical care is directly associated with life and death, temporal indisposition has to be accepted to regain health or to reach the best health status, medical information tends to exist disproportionately on medical personnel [11]. The interpretation of patient satisfaction survey data, therefore, has to be made cautiously, as to show dissatisfaction to medical facilities or personnel could be rather difficult.

In the United States of America, official Hospital Compare data are available on the Medicare.gov Hospital Compare Website provided by the Centers for Medicare & Medicaid Services (CMS) [10]. Medicare is a government program mainly for people aged

over 65. Hospital Compare is a tool that provides information about the quality of care to help consumers to make an informed health care decisions. Hospital Compare includes Hospital consumer assessment of healthcare providers and systems (HCAHPS) patient survey data.

To examine these data will support not only customers' active decision-making, but also hospitals' effort to improve quality of care, and better management.

To our knowledge, the studies on patient satisfaction factors are mainly analysed by correlations, regression analysis and covariance structure analysis which set the objectives as overall-rating, or qualitative studies based on patient interviews or questionnaire. Main factors reported in these surveys are medical care expectation, patient satisfaction experience, relationships with doctors, the quality of received information and health status [3], however, there are only a few studies that examined the structure of patient satisfaction [14], which focus on the relationships between patient satisfaction variables based on their ratings.

2. OBJECTIVES

To look into the factors of patient satisfaction by comparing patient satisfaction structures by survey response size and hospital structure.

3. Methods

3.1 Data source

The HCAHPS scores collected from July 2012 through June 2013 were retreated online [10]. The HCAHPS Patient Survey is a 32-item for measuring patients' perceptions of their hospital experience. It is administered to a random sample of adult inpatients between 48 hours and six weeks after discharge. Then the collected data are adjusted by survey mode and case-mix such as age, self-health recognition, education etc. The six composites summarize how well nurses and doctors communicate with patients, how responsive hospital staff are to patients' needs, how well hospital staff help patients manage pain, how well the staff communicates with patients about medicines, and whether key information is provided at discharge. The two individual items address the cleanliness and quietness of patients' rooms, while the two global items report patients' overall-rating of the hospital, and whether they would recommend the hospital to family and friends.

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Conference '10, Month 1–2, 2010, City, State, Country.

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Table 1. Patient satisfaction survey

Number	Questions	
1	How often did nurses communicate well with patients?	Nurse communication
2	How often did doctors communicate well with patients?	Doctor communication
3	How often did patients receive help quickly from hospital staff?	Staff responsiveness
4	How often was patients' pain well controlled?	Pain management
5	How often did staff explain about medicines before giving them to patients?	Medication information
6	How often were the patients' rooms and bathrooms kept clean?	Cleanliness
7	How often was the area around patients' rooms kept quiet at night?	Quietness
8	Were patients given information about what to do during their recovery at home?	Discharge information
9	How do patients rate the hospital overall?	Overall rating
10	Would patients recommend the hospital to friends and family?	Recommendation

3.2 Data selection

3.2.1 Hospital selection

The original data were aggregated by the provider IDs, then the following hospitals were extracted; 1) hospitals which submitted completed patient surveys, 2) hospitals which submitted survey response rates, 3) hospitals whose data showed no discrepancies on the data collecting process.

3.2.2 Patient survey results

A list of patient satisfaction survey is shown in Table 1. From question 1 through 7 were three-choice frequency ratings; "sometimes or never (low)", "usually (medium)", "always (high)". Question 8 was a close question. Question 9 was a scale question from 1 to 10; 10 or 9 were labelled "high", 8 or 7 were labelled "medium", 6 or be "low" were labelled "low". Question 10 was three-choice rating; no, probably yes and definitely yes.

The survey response sizes were reported in three sizes; less than 100, between 100 and 299 and 300 and over. Data with fewer than 50 were excluded as the number of surveys may be too low to reliably assess hospital performance.

3.2.3 Hospital structural measures and hospital type

The registry of specialty and care, and the system level of electronic health record were used. The former included cardiac surgery, general surgery, nursing care and stroke care. The latter was whether hospitals were able to receive laboratory results electronically (partial EHR), and whether hospitals had more systematic health record (EHR) system.

There were two hospital types, an acute care hospital or a critical access hospital. The former is a hospital that provides inpatient medical care and other related services for surgery, acute medical conditions or injuries (usually for a short term illness or condition). The latter is a smaller rural community hospital that receive cost-based reimbursement [5].

3.3 Analysis

The data were analysed mainly by response size because the response size was surmised to show hospital bed size, and because when accumulated, the percentage-based HCAHPS patient survey data could put weight rather heavily on the data of smaller response size hospital. Chi square tests and multiple proportions

and post hoc analyses were conducted to compare the proportions of the specialty hospitals and hospital type by response size.

R version 3.1.0 was used for statistical analysis.

3.3.1 Correlations

The Pearson's correlation coefficients between the percentages of "high" overall-rating and the other "high" or "yes" patient survey items were examined by response size.

3.3.2 Distant Analysis

Patient satisfaction structures were explored by correspondence analysis, clustering analysis and multidimensional scaling (MDS), based on the contingency tables of nine patient survey questions and their ratings by response size. Closed Question (No. 8) was excluded. Distant analysis is a comprehensive analysis compared to correlations, which will shed light on the interrelationships among items. The result will be discussed with the study of distance analysis in patient satisfaction [4] which reported that for outpatients interpersonal factors of medical personnel are important to move around and to receive information, and that for inpatients environmental factors are important.

4. Results

3711 hospitals were selected out of 4677 hospitals.

4.1 The correlations by response size

In all the response sizes, all the correlations between the "high" "overall rating" and the other "high" and "yes" items were significantly associated ($p < 0.001$), as shown in Table 2.

In the response size between 50 and 99, "recommendation" ($r = .869$) and "nurse communication" ($r = .735$) showed very strong positive correlations with "overall rating". The other seven items showed strong positive correlations ($r = .665 \sim .460$) with "overall rating". "Quietness" was the weakest variable.

In the response size 100 and 299, "recommendation" ($r = .887$), "nurse communication" ($r = .767$) and "staff responsiveness" ($r = .724$) showed very strong positive correlations with "overall rating". The other six items showed strong positive correlations ($r = .653 \sim .491$) with "overall rating". "Quietness" was the weakest question.

In the response size 300 and over, five items showed very strong correlations with "overall rating", which were "recommendation"

**Table 2. Correlation coefficients
between the percentages of “high” overall-rating and the other “high” items by response size**

Response size	Item	r	p	95 percent confidence interval	
50 ~ 99 n=220	Recommendation	0.869	***	0.833	0.898
	Nurse communication	0.735	***	0.667	0.790
	Staff responsiveness	0.665	***	0.584	0.733
	Cleanliness	0.622	***	0.533	0.697
	Doctor communication	0.613	***	0.523	0.689
	Discharge information	0.610	***	0.520	0.687
	Medication information	0.561	***	0.463	0.645
	Pain management	0.558	***	0.460	0.643
100 ~ 299 n=672	Recommendation	0.887	***	0.865	0.905
	Nurse communication	0.767	***	0.726	0.802
	Staff responsiveness	0.724	***	0.677	0.766
	Medication information	0.653	***	0.596	0.703
	Pain management	0.651	***	0.595	0.701
	Discharge information	0.625	***	0.565	0.678
	Cleanliness	0.615	***	0.554	0.669
	Doctor communication	0.577	***	0.512	0.636
300 ~ 2799 n=2799	Recommendation	0.920	***	0.915	0.925
	Nurse communication	0.799	***	0.786	0.812
	Pain management	0.764 †	***	0.748	0.778
	Staff responsiveness	0.730	***	0.713	0.746
	Medication information	0.725 †	***	0.708	0.741
	Doctor communication	0.662	***	0.642	0.682
	Cleanliness	0.644	***	0.622	0.664
	Discharge information	0.635	***	0.613	0.656
Quietness	0.616 †	***	0.593	0.637	

*** p<0.001

†: Items of the hospitals whose response size were 300 and over showed higher coefficients than the same items of the hospitals whose response size were less than 300, according to 95 percent confidence intervals.

($r = .920$), “nurse communication” ($r = .799$), “pain management” ($r = .764$), “staff responsiveness” ($r = .730$) and “medication information” ($r = .725$). The other four items showed strong positive correlations ($r = .662 \sim .616$) with “overall rating”. Three items of the hospitals whose response size were 300 and over showed higher coefficients than the other hospitals, which were “pain management”, “medication information” and “quietness”.

4.2 Patient satisfaction structures by distance analyses by response size

Clustering analyses by Ward’s method were conducted to examine the patient satisfaction structures by response size. Both hospitals whose response size were between 50 and 99, and between 100 and 299 showed the same two clusters, one of which were consisted of

“cleanliness”, “nurse communication” and “doctor communication”, the other cluster were consisted of the rest of the items including “overall rating” and “recommendation”. The former clusters exhibited higher percentages of “high” ratings, lower percentages of “medium” ratings and lower percentages of “low” ratings than the other hospitals. For example, in response size between 100 and 299, the percentages of “high” ratings of the first cluster were ranging from 77% ~ 84%, compared to 66% ~ 72% of the second cluster.

Hospitals whose response size were 300 and over, also showed two clusters, however, with different item combinations. One cluster was consisted of “medication information”, “staff responsiveness” and “quietness”, which showed lower percentage of “high” ratings (58% ~ 64%) than the other cluster

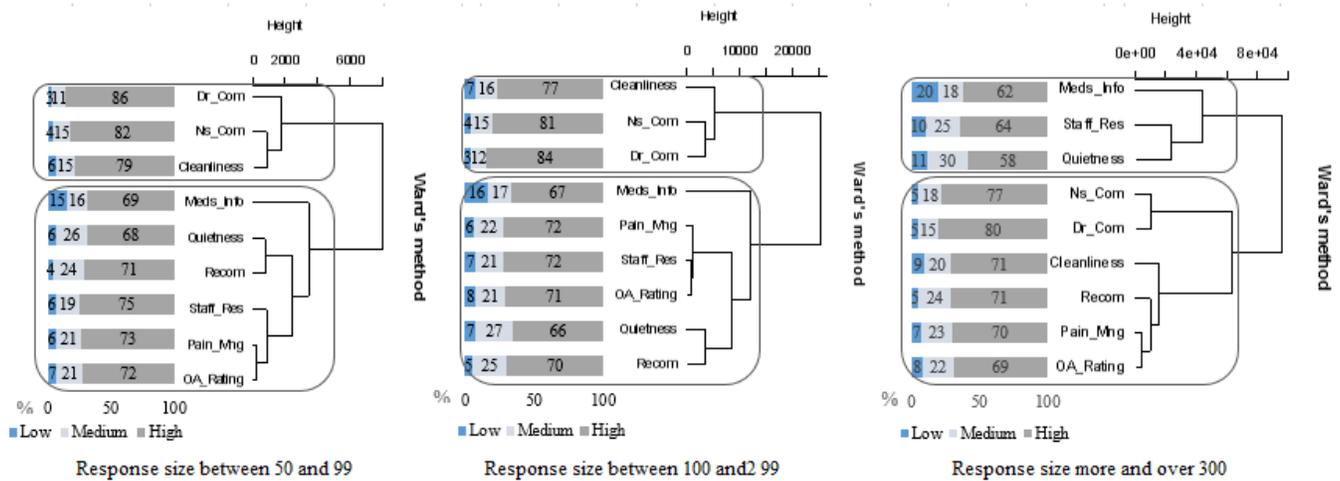


Figure 1. Clustering analyses and distribution graphs by response size

Table 3. Hospital type by response size and multiple proportion test

Response size												Tests of multiple proportions		
50 ~ 99 (A) n = 220				100 ~ 299 (B) n = 692				300 ~ (C) n = 2799				A vs. B	A vs. C	B vs. C
ACH		CAH		ACH		CAH		ACH		CAH		p	p	p
n	%	n	%	n	%	n	%	n	%	n	%			
78	35.5	142	64.5	358	51.7	334	48.3	2709	96.8	90	3.2	***	***	***

*** p<0.001

Abbreviations: ACH, acute care hospital; CAH, critical access hospital

Table 4. Hospital structure by response size and multiple proportion test

Hospital Structure	Response Size												Tests of multiple proportions		
	50 ~ 99 (A) n = 220				100 ~ 299 (B) n = 692				300 ~ (C) n = 2698				A vs. B	A vs. C	B vs. C
	Yes	%	Others*	%	Yes	%	Others*	%	Yes	%	Others*	%	p	p	p
Cardiac surgery	-	0	220	100	8	1.2	684	98.8	1005	35.9	1794	64.1		***	***
General surgery	3	1.4	217	98.6	27	3.9	665	96.1	590	21.1	2209	78.9		***	***
Nursing care	5	2.3	215	97.7	71	10.3	621	89.7	1505	53.8	1294	46.2	***	***	***
Stroke care	11	5	209	95	54	7.8	638	92.2	1518	54.2	1281	45.8		***	***
Partial EHR	81	36.8	139	63.2	309	44.7	383	55.3	2072	74	727	26.0		***	***
EHR	74	33.6	146	66.4	288	41.6	404	58.4	1790	64	1009	36.0		***	***

*** p<0.001 Tests of multiple proportions

* "Others" is the sum of "no", "not available" and blanks. Abbreviation; EHR, Electric hospital record.

(69% ~ 80%), higher percentages of "medium" ratings (18% ~ 30%) than the other (15% ~ 24%) and higher percentages of "low" ratings (10% ~ 20%) than the other (5% ~ 9%). The results are shown in Figure 1.

4.3 Patient satisfaction structures by distance analyses by hospital structure

To further explore the backgrounds of the clustering result difference by response size, contingency tables of hospital structure, such as speciality hospitals and EHR system, by response size were examined according to multiple proportion test and post hoc analysis. The chi square tests for each table by response size in Table 3 and Table 4 showed a significant

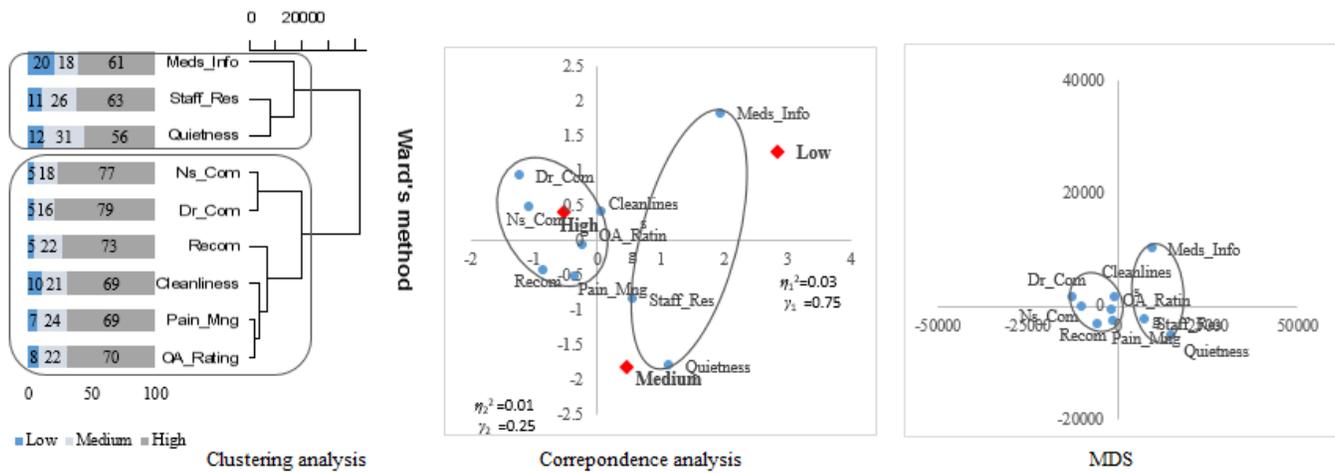


Figure 2. Distance analyses of hospitals which had cardiac surgery department $n=1013$

Abbreviations: Disc inf, discharge information; Dr com, doctor communication; Meds inf, medication information; Ns com, nurse communication; OA-rating, overall rating; Pain mng, pain management; Recom, recommendation; Staff res, staff responsiveness

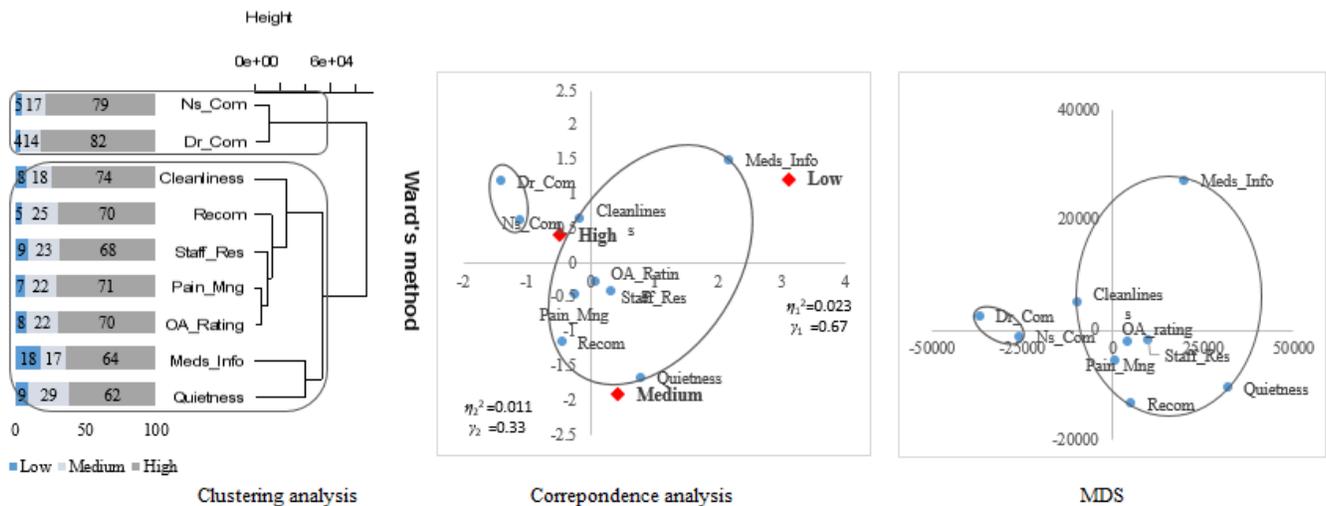


Figure 3. Distance analyses of hospitals which did not have cardiac surgery department $n=2698$

Abbreviations: Disc inf, discharge information; Dr com, doctor communication; Meds inf, medication information; Ns com, nurse communication; OA-rating, overall rating; Pain mng, pain management; Recom, recommendation; Staff res, staff responsiveness

difference ($p < 0.001$). Table 3 shows hospitals whose response size were 300 and over were consisted of 96.8% ACHs. The proportion was significantly larger than the other hospitals ($p < 0.001$). As shown in Table 4, hospitals whose response size were 300 and over showed higher ratio of specialty and care registry, such as cardiac surgery and nursing care, than the hospitals whose response size were less than 300. The ratio of hospitals with partial EHR system or EHR system showed higher ratio than the hospitals without EHR system.

Given that, distant analyses by hospital structure were explored. Hospitals which had cardiac surgery department exhibited two clusters; one cluster included “medical information”, “staff responsiveness” and “quietness”. As shown in Figure 2., those items showed lower percentages of “high” rating (56% ~ 61%) than the other 7 items (69% ~ 79%), higher percentages of “medium” ratings (18% ~ 31%) than the other (16% ~ 24%),

higher percentages of “low” ratings (11% ~ 20%) than the other (5% ~ 10%). The results were also supported by correspondence analysis, in which “medication information”, “quietness” and “staff responsiveness” were placed slightly far from the other items around “high” rating, but closer to “low” and “medium” ratings.

In clustering analysis, hospitals which did not have cardiac surgery department (Figure 2), also exhibited two clusters; one cluster was consisted of “nurse communication” and “doctor communication”. As shown in Figure 3, the two items showed higher percentages of “high” rating (79% ~ 82%) than the other 7 items (62% ~ 74%), lower percentages of “medium” ratings (14% ~ 17%) than the other (17% ~ 29%), lower percentages of “low” ratings (4% ~ 5%) than the other (5% ~ 18%). The results were supported by correspondence analysis, in which “doctor

Table 5. Clustering analyses by hospital structure n=3711

Hospital structure		n	Items included in each one cluster out of two clusters (The other cluster in each registry or system included the rest of the items.)		
Cardiac surgery	Yes	1013	Medication information	Staff responsiveness	Quietness
	Others*	2698	Nurse communication	Doctor communication	
General surgery	Yes	620	Medication information	Staff responsiveness	Quietness
	Others*	3091	Nurse communication	Doctor communication	
Nursing care	Yes	1581	Medication information	Staff responsiveness	Quietness
	Others*	2130	Nurse communication	Doctor communication	Cleanliness
Stroke care	Yes	1583	Medication information	Staff responsiveness	Quietness
	Others*	2128	Nurse communication	Doctor communication	Cleanliness
Partial EHR	Yes	2462	Nurse communication	Doctor communication	
	Others*	1249	Nurse communication	Doctor communication	
EHR	Yes	2152	Nurse communication	Doctor communication	
	Others*	1559	Nurse communication	Doctor communication	

* "Others" means is the combination of "no", "not available" and blank answers.

communication" and "nurse communication" were placed further away from both of "low" and "medium" ratings. MDS results showed similar item distance, though the distance of hospitals which had cardiac surgery department was much closer than that of the other hospitals, which meant that each item evaluation of the former hospitals was similar to each other. Compared to that of the latter hospitals.

The same analyses were conducted on the other hospital structural classifications. As shown in Table 5, both of the hospitals which registered cardiac surgery, or general surgery exhibited the same two clusters, one of which was consisted of "medication information", "staff responsiveness" and "quietness". Hospitals which did not have those department also showed two clusters but consisted of different items, which were "nurse communication" and "doctor communication". Both of the hospitals which registered nursing care or stroke care also showed the same two clusters with the hospitals which had cardiac surgery department. Both of the hospitals which did not register nursing care, or stroke care also showed two clusters, but one of the clusters was consisted of "cleanliness" in addition to "nurse communication" and "doctor communication". Both of the hospitals which had EHR system and which did not have EHR system show exact the same clusters, in which "nurse communication" and "doctor communication" were grouped.

5. Discussion

5.1 The relationships between "overall-ratings" and the other items

It should be noted that to establish the HCAHPS patient survey, patient satisfaction surveys have been reviewed, tested, analyzed and developed over the years [1][7][8][9]. Each survey item is supposed to show strong association with "overall rating".

In this study "Recommendation" had the strongest associations with "overall rating" in all the response sizes, which means that hospital advocacy is greatly associated with patient satisfaction. It is obvious because "willingness to refer others" has been one of the measurements of patient satisfaction since 1980's [15]. That aspect of patient satisfaction is not affected by neither response size difference, nor the decade-long time course. "Nurse

communication" also showed very strong correlations with patient satisfaction despite the response size difference. Many review [12][13][16] support that the impact of nurses' performance, especially interpersonal skills play a significant role for patient satisfaction as nurses have frequent contacts with patients in delivering treatment and care.

At hospitals whose response size were 300 and over, "pain management", "medical information" and "quietness" showed stronger coefficients with "overall rating" than the other hospitals whose response size were smaller. As hospitals whose response size were 300 and over showed higher ratio of ACHs, hospital specialties and care registries, those factors could be affecting the difference. This will be discussed in the distant analysis.

5.1.1 The structure difference of patient satisfaction

At hospitals whose response size were less than 300, communications with medical personnel and cleanliness of the environment as shown in one cluster, received better evaluation than the other factors from patients. Although the percentages of "high" "nurse communication" showed the second strongest correlations with "high" "overall rating", it was not grouped in the same cluster with "overall rating". Instead "pain management" firstly or almost firstly formed the same cluster with "overall rating", even though the percentages of "high" "pain management" showed lower coefficients in all the response sizes than the percentages of "high" "nurse communication" according to 95% confidence intervals. Similarly, the percentages of "high" "recommendation" showed the strongest correlation coefficients around 0.9 with the percentages of "high" "overall rating", it formed the same cluster with "overall rating" in the third or fourth.

Although the coefficients of "high" "doctor communication" with "high" "overall rating" were lower than "high" "nurse communication" with "high" "overall rating" based on 95% confidence interval in both of the response sizes over 100, the two communication factors formed the same cluster in all the response sizes.

Although the better assessed "nurse communication", "doctor communication" and "cleanliness" in both of the response sizes less than 300 showed still better evaluation in response size 300 and over, those three did not formed the different cluster, but

formed the same cluster with “recommendation”, “pain management” and “overall rating”. Instead “medical information”, “staff responsiveness” and “quietness” were grouped in the same cluster.

Nursing care and nurses’ caring attitude, doctors’ technical skills and attitude, such as information giving and willingness to listen to patients, pain management [2][3][16][17], have been reported the important determinants of overall satisfaction, which were also supported in this study, though patients seem to have different expectation for nurses and doctors in different conditions.

Hospitals which had cardiac department showed the same clusters with the hospitals whose response size were 300 and over. Hospitals which did not have cardiac department showed the same clusters with the hospitals whose response size were less than 300.

As the former hospitals showed higher proportions of acute care hospitals (97%), and higher proportions of speciality department or speciality care than the latter, the structure difference could be affected by those factors. Hence, “quietness”, “staff responsiveness”, receiving “medication information” showed different and low evaluation due to the higher opportunities of receiving invasive medical treatment. This will explain overall ratings had stronger correlations between “pain management” and “medical information”.

MDS difference showed similar results, though MDS is calculated for hospitals which had cardiac surgery department and hospitals which had did not. The MDS results of the former hospitals showed closer distance than the other hospitals, which means that at those hospitals patient satisfaction factors will be more strongly related than the other hospitals.

According to the MDS results, patients who need acute care, therefore, may equally perceive communication and pain management important, but need swifter response with better medication information in a quieter environment. That is, treatment and care should be delivered with integration of technical skills, interpersonal skills and environment.

On the contrary, hospitals which did not register those specialties or care, nurse communication and doctor communication showed different tendencies. Patients who need long time care perceive communication with medical personnel differently from “overall rating”.

In Japan, different findings were reported that communication was always associated with overall-rating in clustering analysis for inpatients, and the structure existed especially among elderly people [14]. As is frequently pointed out, Japanese people put great value on communication, compared to American people. The survey was, however, conducted to patients in hospital at general hospital which had over 600 beds in rural city. Patients hospitalized during a survey period could show better evaluation.

5.2 The potential of distant analysis

This study shows distant analysis based on contingency tables exhibited a different approach to the factors of patient satisfaction survey. In patient satisfaction survey it is reported that patients clearly differentiate “satisfied” from “very satisfied”. They choose “satisfied” when they feel the treatment were “adequate” or “average”, and that they choose “very satisfied” when the service was outstanding [2]. Distance analysis is a more comprehensive approach than correlations, as distant analysis use more variables.

5.3 To improve quality of care

Although the results are based on the Medicare data in the States, it will be surmised that medical personnel, especially nurses need to much more focus on explanation on medication information, immediate response to patients’ demands relaxing quiet environment and good pain control. Moreover, technical skills should be provided with interpersonal skills. Hospitals which provide long term care need to focus on communication and to provide good environment.

5.4 Limitation

Medicare is mainly for people over aged 65, the study should be compared to other studies on people with other medical insurance and people aged under 64. [10]. The analyses are also limited to hospital specialties. Further study should be followed.

6. Conclusions

Distant analysis, which use more variables than two-variable based correlations, will be able to show different aspect of patient satisfaction factors.

To improve patient satisfaction, interpersonal skills should be developed.

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