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Prediction of Hospitalization Length. Quantile Regression Predicts Hospitalization Length and its Related Factors better than Available Methods

M. Kazemi[1], S. Nazari[1], N. Motamed[2], S. Arsang-Jang[1], R. Fallah[1]

Key words: Length of hospital stay, Iran, Quantile regression model, hospital discharge
Parole chiave: Durata della degenza ospedaliera, Iran, Modello di regressione quantile, Dimissione ospedaliera

Abstract

Background. *Length of hospitalization is one of the most important indices in evaluating the efficiency and effectiveness of hospitals and the optimal use of resources. Identifying these indices' associated factors could be useful. This study aimed to investigate effective factors of the length of hospitalization in Zanjan teaching hospitals in 2018 using the Quantile regression model.*

Methods. *This cross-sectional study was conducted on 1,031 patients. The study population consisted of patients in orthopaedic, pediatric, internal, surgical and intensive care units. The samples were selected by multistage random sampling. The information was collected by a pre-designed checklist. The Quantile regression model and ordinary regression model were performed on the data.*

Results. *Of the 1,031 patients admitted to different units, 624 (60.52%) were male. Mean and standard deviation of length of hospitalization for men, women and all patients were 7.25±5.48, 8.09±6.35 and 7.58±5.83 respectively. For 90 percent of patients the length of hospitalization was less than 14 days. Twenty-five percent of patients in pediatric and orthopedic units and ten percent of patients in internal and surgery units were hospitalized less than three days. In all quantiles, patients' length of hospitalization in surgery and orthopedic units, compared to the intensive care unit, and patients hospitalized for injuries and poisonings compared to other causes, had a statistically significant difference. ($p<0.05$).*

Conclusions. *Due to the heterogeneity (skewness) of the length of hospital stay in different units of the hospital, the quantile regression model predicts the length of hospital stay more precisely than the ordinary regression models.*

Introduction

In recent years, due to the increasing population growth, hospitals have been developed remarkably and they are an important part of the health system of Iran. Their performance in harmony with a range of other organizations leads to the health of the society. So, they are one of the key units in the health system and have an important role in providing health-care services. In addition, the hospital is one of the organizations that different strata of society, regardless of age, sex, race, and

[1] *Department of Biostatistics and Epidemiology, School of Medicine, Zanjan University of Medical Sciences, Zanjan, Iran*
[2] *Department of Health Care Management, Zanjan Social Health Research Center, Zanjan University of Medical Sciences, Zanjan, Iran*

religion, refer to. Therefore, the request for using hospital services is increasing (1, 2). Rising requests have led to bed deficiencies and a lack of resources for patient care in hospitals (3-5).

One of the existing problems in treatment and hospitalization units is the long hospital stay, which eventually leads to waste of resources, depreciation of hospital equipment, growing risk of hospital infections, waste of the patient's time and unproductive costs (6). Therefore, the length of hospital stay is the main cause of cost and waste of resources in hospitals (7). The length of hospital stay is an important index that is widely used today and is one of the most useful and applicable hospital indices that evalute the productivity and performance of hospital activities and is therefore an essential element in hospital performance analysis (6). Accurate and comprehensive information on the length of hospital stay should be a high priority for managers and health planners in strategic planning and the allocation of financial, human and physical resources. As a result, due to the lack of medical centers, staff and supplies and to the increasing costs of healthcare, it is important to optimize the length of stay and its effective factors (8).

In a study conducted in Governmental hospitals of Lorestan province, the mean of hospital stay was 3.03 days (2). In a nationwide study in 2001, the mean was 3.7 days (9). Length of hospitalization median was 4 days in the Ameri et al research (8). In a study conducted in Australia among patients over 85 years of age, the mean of hospitalization was 27.5 days (10).

There have been several studies on factors affecting long-term stay of patients and various methods have been used in data analysis, but the *quantile regression model* has been rarely mentioned (2, 8).

The present study aimed to determine the factors affecting the length of hospitalization, and we decided to apply the quantile regression model. In our case, the length of hospitalization was highly dispersed and its distribution was asymmetric and skewed, a situation suggesting to use the quantile regression analysis for our data.

Methods

This cross-sectional study was performed on patients who had been hospitalized at the Ayatollah Mousavi and Valiasr hospitals, Zanjan, Iran. The data were collected using standard checklist by a trained medical advisor. The target population included the patients in pediatric, orthopedic, surgical, internal, and intensive care units, who were admitted to the hospitals in the spring and summer of 2018. The sample size was estimated using sample size formula for multiple regression models. According to the sample size formula for regression models, considering the type I error equal to 5%, 80% power, 0.02 expected effect size, and the number of predictors in the model, minimum 1,030 individuals were estimated to be necessary for the study. The patients were selected randomly in two steps based on the file number and the number of patients in each hospital unit. The first step was a stratified proportional allocation sampling and the second was a simple random sampling in which the random numbers were generated by R software. The data were collected with the direct presence of the researcher in the medical records archive of the pertinent hospitals. The length of hospitalization until hospital discharge was considered as the dependent variable. The variables of the study included sex, age, marital status, admission type, place of residence, type of insurance, hospitalization unit, cause of hospitalization and health status at the discharge. The data were analyzed using quantile regression model in SAS software version 9.4.

The Quantile regression was first introduced by Koenker and Bassett,

which modeled the conditional quantiles of the dependent variable as a function of independent variables. The quantile regression model is an extension of the linear regression model and is dealing with changes in conditional quantiles. Parameters of model in linear regression are estimated by minimizing the residuals of the model, but quantile regression minimizes the sum of the weighted residual's absolute value of the model. This method is not sensitive to outliers, therefore, only the number of residues that are more or less than the desired quantity will affect the parameter estimation (11-13). $P<0.05$ was considered as statistically significant (with 95% confidence interval).

Results

The cross-sectional study began with the review of the documents of the 1,031 patients. The characteristics of the samples are presented in Table 1. In terms of discharge status, 194 (18.8%) patients showed complete remission, 731 (70.9%) partial remission, 82 (8%) left the hospital voluntarily, and 24 (2.3%) died. The largest proportion of patients was in the surgery units (44.3%) and the lowest was in the intensive care units (7.2%). The diseases of the musculoskeletal system, with 271 (26.3%) patients, and the diseases of the metabolic system, with 102 (9.8%) patients, were the most and the least common cause of hospitalization, respectively (Table 1).

The different quantile values of length of hospital stay for each unit are represented in Table 2. The first quantile was 4 days, i.e. length of hospital stay for 25% of patients were up to 4 days. The mean $\pm$ $\pm$SD of the length of hospital stay was 7.58 ± 5.83 7.58 ± 5.83 and 90% of patients were hospitalized for less than or equal to 14 days. In addition, 25% of patients in pediatric and orthopedic units and 10% of patients in internal and surgical units were hospitalized for less than 3 days. In Intensive Care Unit, 50% of patients were hospitalized for less than 10 days.

Table 3 presents findings on a linear regression model and quantile regression model in selected quantiles (90, 75, 50, 25, 10) of length of hospital stay. In the linear regression model, patients' age was associated with length of hospitalization and regression coefficient was 0.07. The average length of hospital stay was increased 0.07 days with one year increase in age. Married patients' length of hospitalization was 1.4 days shorter than single patients and this difference was statistically significant ($p=0.016$). Discharge status, hospitalization unit, and cause of hospitalization had a significant effect on the length of hospitalization ($p<0.05$).

Age, marital status, residence place, admission type, discharge status, type of insurance, hospitalization unit, and cause of hospitalization had a significant effect on the tenth quantile of the length of hospitalization. In the first quantile sex, age, residence place, admission type, discharge status, hospitalization unit, and cause of hospitalization were the variables that influenced the length of hospitalization. Sex, age, marital status, discharge status, hospitalization unit, and cause of hospitalization had a significant effect on the median model. The variables of sex, age, marital status, discharge status, hospitalization unit, and cause of hospitalization were significant in the model fitted to the third quantile of hospitalization. Finally, at the 0.9 quantile, age, marital status, discharge status, type of insurance, hospitalization unit, and cause of hospitalization had a significant influence on the length of hospitalization. In different quantiles, the values of increase in hospital stay varied by one year of age. Whereas, this value was 0.05 days in the first quantile and 0.1 days in the third quantile. In all quantiles, the difference in the length of hospitalization

Table 1 - Demographic characteristics of the individuals and the length of hospitalization

Variable		Frequency	Percentage	Mean	SD
Sex	Male	624	60.52	7.25	5.48
	Female	407	39.48	8.09	6.35
Marital status	Single	531	51.5	8.95	6.52
	Married	500	48.5	6.12	4.63
Location	Urban	719	69.74	7.55	6.22
	Rural	312	30.26	7.65	4.92
Admission Type	Referral	298	28.9	7.55	5.77
	Emergency	733	71.1	7.65	6.06
Discharge Status	Complete Remission	194	18.8	6.4	4.13
	Partial Remission	731	70.9	7.67	5.9
	Discharge by personal decision	82	8	7.04	4.48
	Death	24	2.3	16.33	11.06
Insurance Type	Health	427	41.42	7.73	5.99
	Armed Forces	189	18.33	7.17	5.48
	Social Security	363	35.21	7.41	5.8
	Free	25	2.42	8.48	5.98
	Other (banks)	27	2.62	9.5	6.65
Hospitalization Unit	Pediatric	155	15.03	5.36	3.06
	Orthopedic	91	8.82	6.11	4.21
	Internal	254	24.64	9.2	5.5
	Surgery	457	44.33	6.84	5.05
	Intensive Care Unit	74	7.18	13.06	11.03
Hospitalization Cause	Metabolic diseases	102	9.89	7.07	4.91
	respiratory system diseases	125	12.12	9.15	5.81
	Diseases of the musculoskeletal system	271	26.29	7.62	6.65
	digestive system diseases	211	20.47	7.24	4.98
	Injuries and Poisonings	153	14.84	5.77	3.69
	Other	169	16.39	8.37	7.06

Table 2 - The Quantile values of length of hospitalization

Variable/Quantile		10	25	50	75	90	Mean
length of hospitalization		3	4	6	10	14	7.58
Unit	Pediatric	2	3	5	7	9.4	5.36
	Orthopedic	2	3	4	8	13.6	6.11
	Internal	3	5	8	12	17	9.2
	Surgery	3	4	5	9	13	6.84
	Intensive Care Unit	4	6	10	16	25	13.6

of patients in surgery and orthopedic units compared to the intensive care unit was statistically significant ($p<0.05$). In the ninetieth quantile, the difference in length of hospitalization in the surgery and orthopedic units compared to the intensive care unit was -7.46 and -8.33 days, respectively. The internal unit compared to the intensive care unit had significant difference only in the 0.1 and 0.9 quantiles ($p <0.05$).

Figure 1 shows quantile regression coefficient estimation with 95% C.I of length of hospitalization versus injury, poisoning, and certain other consequences of external causes (right above), endocrine, nutritional and metabolic diseases (left center), diseases of the respiratory system (right center), diseases of the digestive system (left below) and diseases of the musculoskeletal system (right below) with other hospitalization causes as base category.

Figure 2 shows quantile regression coefficient estimation with 95% C.I of length of hospitalization versus admission type and discharge status. Emergency entry method (left above) with referral entry method as base category, partial remission (right above), discharge by personal decision (left below), complete remission (right below) with death as base category are shown in this figure.

Figure 3 shows quantile regression coefficient estimation with 95% C.I of length of hospitalization versus surgery unit (left above), orthopedic unit (right above), pediatric unit (left below) and internal unit (right below) with Intensive Care Unit as base category.

In all of the figures there is much more difference in upper quantiles than lower ones. For example, in figure 1 right above curve, at the 0.2 quantile, the length of hospital stay in injury, poisoning, and certain other consequences of external causes' category is one day shorter than the baseline.

Discussion and Conclusions

In the present study, there was a significant relationship between age and length of hospitalization in different quantiles. There was no significant association between age and length of hospitalization in Poorreza et al research conducted in the infectious unit of Ahvaz Razi Hospital (14). In the study of Khazaei et al., which investigated the length of hospitalization in the emergency department, there was a direct association between age and length of hospitalization (7). Karim et al showed a significant relationship between age and length of hospitalization's mean in their study so that, the length of hospitalization of children and middle-aged people was longer than that of young people (4). In the study of Arab et al., the average length of hospital stay was increased, with increasing in age (2). Based on these results, it can be said that older patients experience more chronic diseases with more morbidities, which makes their therapeutic management more challenging and therefore requires more time to recover their disease. However, young people are frequently to develop acute diseases and, even if they have chronic diseases, experience fewer morbidity, have a better prognosis, and thus have shorter treatment time (15). In this study, there was no significant association between patients' length of hospitalization and insurance type, but in 0.9 quantile, patients with Armed Forces insurance had about 5 days higher length of hospitalization than patients without insurance. The effect of the insurance variable was significant in the study of Pourreza et al. on the length of hospitalization (14). Patients without insurance had the least length of hospitalization in Karim et al study (4), which is consistent with the results of the present study. In a study conducted by Ameri, Insurance type had no effect on the length of hospitalization (8). Results of Ravangard et al and Arab et al studies also

Table 3 - Comparison of the results of ordinary regression model (OLS) with Quantile regression model to predict the hospitalization length

Variable		OLS Model	Quantiles				
		OLS (95 % CI) p-value	10 (95 % CI) p-value	25 (95 % CI) p-value	50 (95 % CI) p-value	75 (95 % CI) p-value	90 (95 % CI) p-value
Gender	Male/Female	-0.56 (-1.26,0.14) 0.12	-0.1 (-0.35,0.14) 0.41	-0.34 (-0.68,-0.007) 0.044	-0.53 (-1.03,-0.03) 0.034	-0.8 (-1.59,-0.02) 0.04	-0.69 (-1.75,0.36) 0.19
Age (year)		0.07 (0.06,0.08) <0.001	0.03 (0.02,0.038) <0.001	0.05 (0.04,0.06) <0.001	0.07 (0.06,0.09) <0.001	0.1 (0.08,0.13) <0.001	0.09 (0.06,0.13) <0.001
Marital status	Married /Single	-1.38 (-2.5,-0.26) 0.016	-0.49 (-0.88,-0.1) -0.01	-0.5 (-1.03,0.02) 0.06	-0.96 (-1.74,-0.17) 0.016	-1.93 (-3.16,-0.7) 0.002	-3.08 (-4.74,-1.42) <0.001
Location	City/ Rural	-0.138 (-0.88,0.6) 0.72	-0.26 (-0.52,-0.004) 0.046	-0.44 (-0.8,-0.09) 0.013	-0.46 (-0.98,0.06) 0.08	0.08 (-0.74,0.9) 0.84	-0.23 (-1.35,0.88) 0.67
Admission Type	Emergency/ Referral	0.13 (-0.63,0.89) 0.73	0.44 (0.17,0.7) 0.001	0.58 (0.22,0.94) 0.001	0.5 (-0.03,1.03) 0.066	0.08 (-0.75,0.92) 0.84	0.25 (-0.87,1.38) 0.66
Discharge Status (death*)	Complete Remission	-4.93 (-7.47,-2.38) <0.001	-0.93 (-1.81,-0.04) 0.038	-2.38 (-3.59,-1.17) <0.001	-4.8 (-6.58,-3,01) <0.001	-6.32 (-9.12,-3.51) <0.001	-8.16 (-11.94,-4.38) <0.001
	Partial Remission	-4.45 (-6.93,-1.96) <0.001	-0.7 (-1.57,0.15) 0.1	-2.51 (-3.68,-1.33) <0.001	-4.87 (-6.61,-3.13) <0.001	-7.03 (-9.77,-4.3) <0.001	-7.56 (-11.24,-3.88) <0.001
	Discharge with Personal Desire	-5.59 (-8.25,-2.92) <0.001	-0.38 (-1.3,0.54) 0.42	-2.83 (-4.09,-1.56) <0.001	-5.49 (-7.36,-3.62) <0.001	-8.56 (-11.5,-5.36) 0.001	-9.43 (-13.4,-5.47) <0.001

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Insurance Type (None*)	Health	0.63 (-1.54,2.8) 0.57	0.091 (0.66,0.84) 0.81	0.32 (-0.7,1.35) 0.53	0.07 (-1.45,1.6) 0.92	0.93 (-1.46,3.33) 0.44	2.84 (-0.39,6.07) 0.08
	Social Security	0.61 (-1.56,2.78) 0.58	0.11 (-0.64,0.86) 0.76	0.37 (-0.65,1.4) 0.47	0.34 (-1.17,1.87) 0.65	1.08 (-1.31,3.47) 0.37	2.23 (-0.99,5.46) 0.17
	Armed Forces	1.54 (-0.75,3.83) 0.19	0.49 (-0.3,1.29) 0.22	0.57 (-0.51,1.66) 0.29	0.65 (-0.95,2.26) 0.42	2.36 (-0.17,4.89) 0.067	4.97 (1.55,8.38) 0.004
	Other (banks)	1.49 (-1.43,4.41) 0.31	1.1 (0.09,2.12) 0.032	0.84 (-0.53,2.23) 0.23	1.19 (-0.85,3.24) 0.25	2.02 (-1.19,5.24) 0.21	3.84 (-0.49,8.18) 0.082
Hospitalization Unit (Intensive Care Unit*)	Surgery	-3.96 (-5.52,-2.39) <0.001	-1.08 (-1.62,-0.53) <0.001	-1.04 (-1.78,-0.3) 0.005	-1.52 (-2.62,-0.43) 0.006	-4.83 (-6.55,-3.11) <0.001	-7.46 (-9.78,-5.14) <0.001
	Internal	-2.13 (-3.73,-0.52) 0.009	-0.67 (-1.22,-0.11) 0.017	-0.57 (-1.32,0.18) 0.14	-0.18 (-1.3,0.94) 0.75	-1.64 (-3.4,0.12) 0.068	-3.06 (-5.44,0.68) 0.011
	Pediatric	-3.43 (-5.31,-1.54) <0.001	-0.92 (-1.57,-0.26) 0.005	-0.37 (-1.27,0.51) 0.4	-0.71 (-2.04,0.6) 0.28	-3.73 (-5.81,-1.65) <0.001	-8.12 (-10.9,-5.31) <0.001
	Orthopedic	-4.04 (-5.98,-2.09) <0.001	-1.06 (-1.74,-0.38) 0.002	-1.16 (-2.08,-0.23) 0.018	-1.6 (-2.9,-0.23) 0.021	-4.19 (-6.33,-2.04) <0.001	-8.33 (-11.23,-5.44) <0.001
Hospitalization Cause (Other*)	Injuries and Poisonings	-1.97 (-3.26,-0.76) 0.003	-0.66 (-1.11,-0.21) 0.003	-1.03 (-1.64,-0.42) <0.001	-1.38 (-2.29,-0.47) 0.002	-2.63 (-4.05,-1.2) <0.001	-3.68 (-5.61,-1.76) <0.001
	Metabolic diseases	-2.26 (-3.61,-0.9) 0.001	0.05 (-0.42,0.52) 0.9	-0.96 (-1.61,-0.32) 0.003	-2.15 (-3.1,-1.19) <0.001	-2.84 (-4.34,-1.34) <0.001	-3.97 (-5.99,-1.95) <0.001
	respiratory system diseases	-0.57 (-1.84,0.7) 0.37	0.09 (-0.34,0.54) 0.66	-0.17 (-0.78,0.42) 0.56	-0.11 (-1.01,0.78) 0.8	-1.16 (-2.57,0.24) 0.106	-1.25 (-3.15,0.65) 0.19
	digestive system diseases	-0.85 (-1.96,0.26) 0.13	0.22 (-0.16,0.61) 0.26	-0.41 (-0.94,0.12) 0.12	-0.8 (-1.59,-0.02) 0.044	-1.53 (-2.77,-0.3) 0.014	-1.53 (-3.19,0.13) 0.07
	Diseases of the musculoskeletal system	-0.3 (-1.43,0.83) 0.6	-0.4 (-0.79,-0.006) 0.046	-0.53 (-1.07,-0.001) 0.049	0.57 (-1.37,0.21) 0.15	-1.02 (-2.27,0.22) 0.106	-0.54 (-2.22,1.14) 0.52

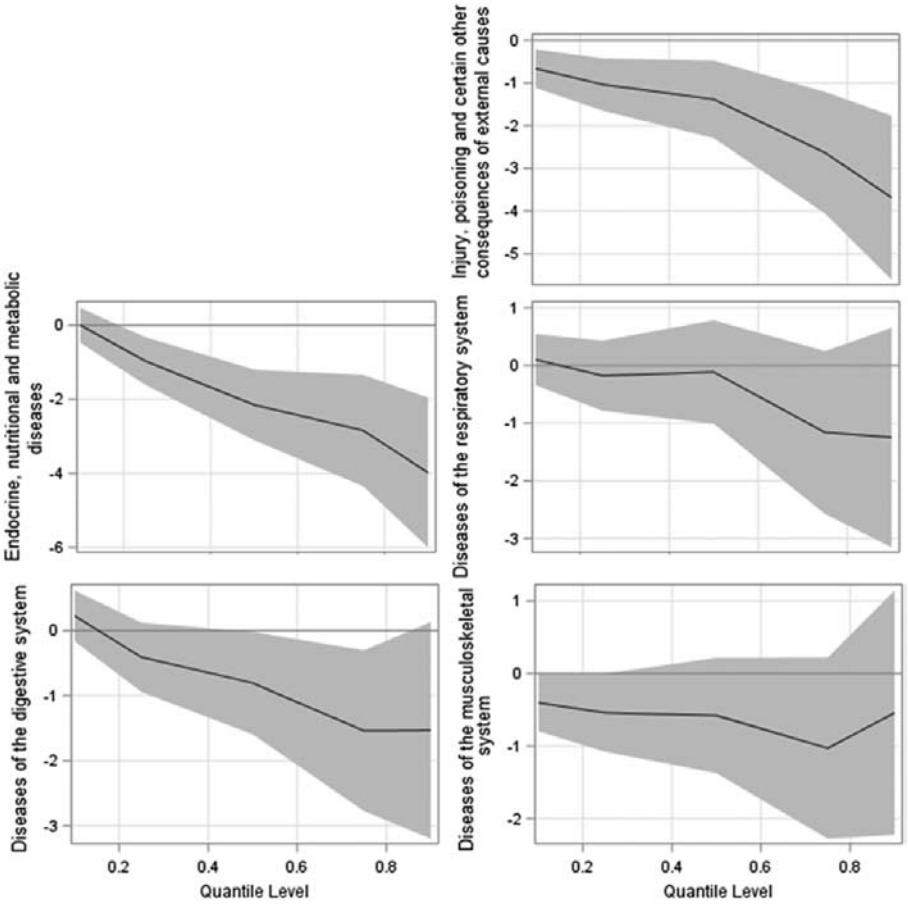

Fig. 1 - The estimated quantile parameters level of hospitalization cause Variable

showed insurance type affects the length of hospital stay (2, 16). The insurance impact on the length of hospitalization can be analyzed from both the doctor and patient dimensions. Physician orders discharge more carefully for insured patients, with this assurance that they cost less. From the patient's perspective, the influence of patient's priorities on the physician's decision can be considered as effective in this regard.

The results of this study displayed that the length of hospitalization was different in various units. Patients hospitalized in surgery and orthopedic units had a significant difference in length of hospitalization compared to patients in the intensive care unit. The pediatric and internal units had a significant difference in length of hospitalization compared to the intensive care unit in 0.1, 0.75 and, 0.9 quantiles and 0.1 and 0.9 quantiles, respectively. In the Karim study, burn, intensive care, and cardiac care units had the highest length of hospitalization, which is consistent with the results in our research. Acute disease and illness worsening can be one of the reasons for the higher length of hospitalization in these units (4). Ameri et al. used logistic regression to fit the model, in which the hospitalization unit was one

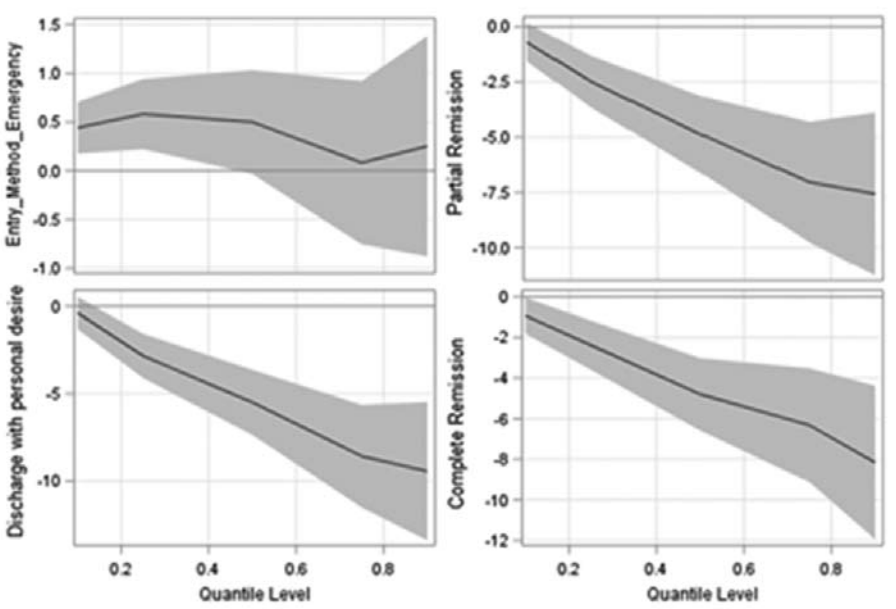

Fig. 2 - The estimated quantile parameters level of discharge status and admission type variables

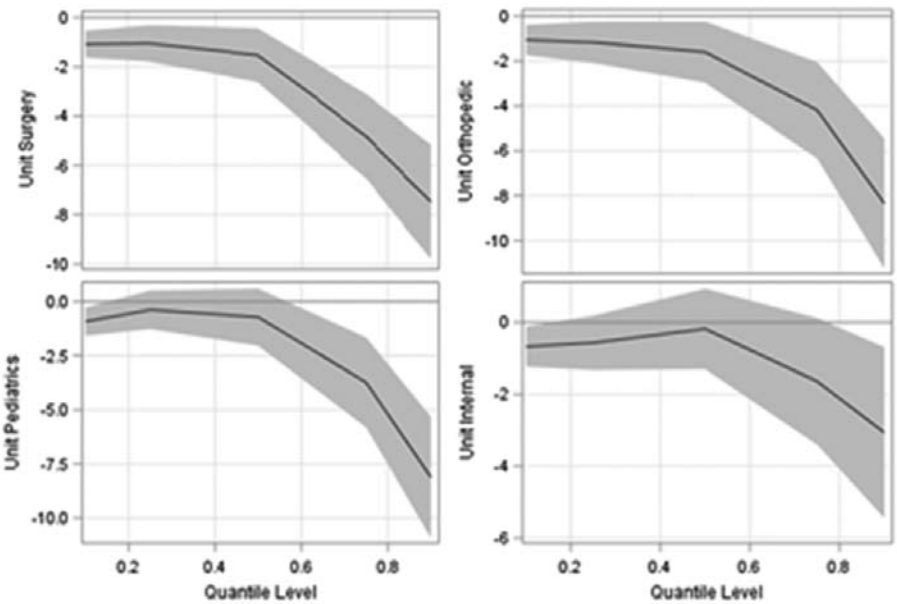

Fig. 3 - The estimated quantile parameters level of hospitalization unit variable

of the influencing variables on the length of hospitalization. The odds ratio of having more than four days length of hospitalization in the internal unit was 1.6 compared to the orthopedic unit. The odds ratio (OR) was less than one for the other units (8).

Hospital infection in Khatami's study was one of the causes of long hospitalization, which took place in the general intensive care unit. The important thing here is that infections increase the length of hospitalization or that prolonged hospitalization may increase the risk of infection. Barnet in his study showed that this pathway is from infection (exposure) to prolonged hospitalization (outcome) (17, 18).

We show that in different quantiles, men's length of hospitalization was shorter than women's. The mean length of hospitalization in women and men was 8.1 and 7.25 days, and the median length of hospitalization was 6 and 5 days, respectively. In the study of Ameri et al, the median length of hospitalization was 4 and 5 days in males and females, respectively, but there was no significant association between this variable and the length of hospitalization (8). In the Arab study, there was a significant association between sex and length of hospitalization. Most of the hospitalized patients were women, but the mean length of hospitalization was longer for men than for women (2). Similar studies have also shown that women use health care more frequently than men (8, 19). In Ghafouri and Khazaei's study, which analyzed the length of hospitalization in the emergency unit, there was no significant association between sex and length of hospitalization (7, 20). Sex had a significant effect on the length of hospitalization in Imam Reza Hospital but there was no significant association between sex and length of hospitalization in Qaem Hospital (4). In our study, the length of hospitalization of married patients was shorter than single patients, except for the first quantile. In the study conducted by Ameri and Pourreza, marriage status had no significant effect (8, 14). In the Ravangard study, single patients had a longer length of hospitalization than married patients, which is consistent with our study (16). In 0.1 and 0.25 quantiles, urban patients had less length of hospitalization. In the linear regression model, there was no association between residence and length of hospitalization. The length of hospitalization of rural patients was higher than urban patients in the Pourreza study (14). Karim and Ameri did not find a significant association between residence and length of hospitalization (4, 8). The reason that there was a significant difference between the length of hospitalization of urban and rural patients in the early quantiles can be attributed to the greater and faster access of urban patients to the hospital than the rural patients. The effect of disease severity and sickness worsening can be attributed to the lack of differences between the two groups in other quantiles. Patients hospitalized for injuries had a significant difference in length of hospitalization compared to the other causes. Patients hospitalized for metabolic diseases had a shorter length of hospitalization than those for other causes, except for 0.1 quantile. Patients with gastrointestinal problems had a lower length of hospitalization than the baseline group (0.5 and 0.75 quantiles). In 0.1 and 0.25 quantiles, the length of hospitalization of patients with musculoskeletal problems was significantly different from baseline. In the Ameri study, the odds ratio of infectious and parasitic diseases compared to baseline was 5.4. The odds ratio for musculoskeletal diseases was 3.1, i.e. that the odds of staying longer than 4 days in hospital in musculoskeletal patients were 3.1 times that of the baseline. The diseases of the nervous system were in the next category with an odds ratio of 2.6 (8).

It is better to examine the length of hospitalization in a particular disease or unit to determine its effective factors

more precisely. To collect comprehensive information nurses should be involved because of their expertise in various fields. In other words, if possible, it is better the nurses collect the information.

Our study has limitations regarding missing data of the archived records of individual information. The lack of baseline and important clinical variables, including the severity of disease, economical status, comorbidity factors, and possible effective factors on hospitalization time required by the researcher in this study was collected through the study of section. Since most of the medical records do not contain all the information required by the researchers, in this study some of the study variables were not included in the records and, therefore, the variables were eliminated. However, the sample size of this study was very large using multicenter sources, that play an important role for controlling effects of latent variables in prediction of hospitalization length.

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Riassunto

Predizione della durata della degenza ospedaliera. La regressione quantile predice la durata della degenza ed I fattori ad essa connessi meglio dei metodi attualmente disponibili

Premessa. La durata della degenza è tra gli indicatori più importanti per valutare l'efficienza e l'efficacia degli ospedali e dell'uso che fanno delle risorse. Assai utile è poi identificare i fattori associati a questo indicatore. Il presente studio ha come obiettivo di identificare detti fattori che influenzano la durata della degenza negli ospedali di insegnamento di Zanjan in Iran nel 2018, utilizzando il *modello di regressione quantile*.

Metodi. Questo studio trasversale è stato condotto su 1.031 pazienti. La popolazione consisteva di tutti i pazienti presenti nei Reparti di Ortopedia, Pediatria, Medicina interna, Chirurgia e Rianimazione dei due ospedali di insegnamento durante il periodo di studio. Il campionamento è stato effettuato con metodo multi-stage random. I dati sonio stati raccolti con un modulo predisposto *ad hoc*. Il modello di regressione quantile e quello di regressione standard sono stati applicati ai dati raccolti.

Risultati. Dei 1.031 soggetti campionati nei diversi Reparti, 624 (60,52%) appartenevano al sesso maschile. Media e deviazione standard della durata di degenza sono risultate rispettivamente, per maschi, femmine e totale, di 7,25±5,48, 8,09±6,35 e 7,58±5,83. Per il 90% dei pazienti la durata della degenza è risultata inferiore ai 14 giorni. Il 25% dei pazienti dei Reparti di Pediatria ed Ortopedia, ed il 10% di quelli di Medicina Interna e di Chirurgia sono rimasti degenti per meno di 3 giorni. A livello di tutti i quantili, si è osservata una differenza statisticamente significativa ($p<0,05$) nella durata della degenza tra i pazienti ricoverati in Chirurgia ed Ortopedia e quelli della Rianimazione, e tra i pazienti ricoverati per ferite o avvelenamenti e quelli ricoverati per tutte le altre diagnosi.

Conclusioni. Data l'asimmetria (skewness) nella durata della degenza nei differenti Reparti ospedalieri, il modello di regressione quantile è risultato predittivo della durata della degenza con più precisione dei tradizionali modelli di regressione.

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Corresponding author: Ramazan Fallah, Department of Biostatistics and Epidemiology, School of Medicine, Zanjan University of Medical Sciences, Ghavazang Blv, Zanjan, Iran
e-mail: rfv@zums.ac.ir