

## REGIONAL FACTORS RELATED WITH THE NUMBER OF AMBULANCE USERS

Kazuya Ikenishi<sup>1</sup>, Jumpei Matsuura<sup>2</sup>

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**Author details:** <sup>1</sup> School of Nursing, Aichi Kiwami College of Nursing, Japan

<sup>2</sup> School of Nursing, University of KinDai Himeji, Japan

**Corresponding author:** Kazuya Ikenishi

School of Nursing, Aichi Kiwami College of Nursing, Japan

**Email:** [k.ikenishi.t@aichi-kiwami.ac.jp](mailto:k.ikenishi.t@aichi-kiwami.ac.jp)

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### ABSTRACT

**Introduction:** Ambulance use was increasing along with growth population of aged in Japan. The purpose of study paper is to clarify the relationship between the state of healthcare service use as well as regional characteristics and ambulance use on regions. The regions that were focused on in this study were 16 wards in Nagoya city, and those data for the past 10 years was analyzed. **Methods:** Analyzed variables in this study were those in previous studies reported had statistical significant with the number of ambulance use, as well as dummy variables represented year. These variables involved population and the number of household, the proportion of population aged 65 or over, the population of foreigners, proportion of livelihood protection recipients, regional health promotion measures, the proportion of health-checkups user, the number of retained motor vehicles. Spearman's rank correlation coefficient and multiple regression analysis were used. **Results:** This study included 160 data on 16wards in Nagoya city from 2004 to 2013. Results of multiple regression analysis showed that 6 variables were statistically significant: the number of households, population of foreigners, proportion of livelihood protection recipients, Colon cancer examinee rate, the number of participants in regional health promotion measures, the number of beds per 100,000 populations. **Conclusion:** This study founded that the variables related with the number of ambulance user were the number of households, population of foreigners, proportion of livelihood protection recipients, Colon cancer examinee rate, the number of participants in regional health promotion measures, number of beds per 100,000 populations.

### INTRODUCTION

In recent years, it has been showed that ambulance use continues to increase in Japan. The number of ambulance's dispatch was about 5910000, and about 5340000 people were transported by ambulance in Japan at 2013. The ambulance use is very valuable medical resources. If someone calls the ambulance in spite of not being necessary rapid examine and treatment, he/she might prevent anyone who should be taken medical service as soon as possible from using it.

It has been continued to increase the aged population rate (65 years or over), emergency medical system play the important role in region. Therefore, it considered that it was necessary to clarify the factors related with the number of ambulance users.

This study focused on regional characteristic such as population and state of healthcare service use, and aimed to explore the relation between them and the number of ambulance users.

Among previous studies on the number of ambulance users, it seemed these one analyzing related factors were few. Some studies which analyzed carried patient's income level and school background and so on were founded [1-3]. However, except for Ishi<sup>[4]</sup> and Oshige<sup>[5]</sup>, it was not founded studies that analyzed corelation between regional factors with the number of ambulance

users.

This study analyzed factors in terms of providing medical services on region as well as those statistically significant related with the number of ambulance users in previous studies<sup>[4,5]</sup>. Analysis data in this study were published one in term of 16 wards in Nagoya city. By means of analyzing characteristics of region, it was considered possible to apply results of this study for providing emergency medical system in the near future.

The purpose of this study is to clarify the relationship between the state of healthcare service use as well as regional characteristics and ambulance use on regions. The regions that were focused on in this study were 16 wards in Nagoya city, and those data for the past 10 years was analyzed.

Nagoya city is the prefectural capital of Aichi prefecture. Aichi prefecture locates in Tokai area, Japan and the population of Aichi was approximately 7.4 million and Nagoya city was approximately 2.3 million in 2015. And the manufacturing industry such as the automobile one is very active in there. These analyzed data were collected on Nagoya city's homepages and provided from it's fire department emergency department.

The health checkup such as cancer screening is one of regional healthcare services. Cancer screenings are also

included in public healthcare promotion services that have been provided by municipalities since Health Promotion Law was enforced at 2002. A malignant neoplasm is most cause of death in Japan, and death ratio of it has a tendency to increase. The mortality due to cancer occupied 28.5% among Japanese death and also most one of death among population aged 40 or over. This upward trend has been continued. Lung cancer and gastric cancer, colon cancers were most among deaths from it by internal organ tissues. People aged 40 or over are able to have screening of lung cancer and gastric cancer, colon cancer at a low fee annually. Ishi<sup>[4]</sup> and Oshige<sup>[5]</sup> reported the examination ratio of health checkups was related with the number of ambulance use statistically significant. Therefore, this study analyzed the relationship between ambulance use and use ratio of cancer screening. In addition their ones, factors which represented state of region were analyzed. Specifically, population ratio of foreigners and recipient proportion of livelihood protection, the number of retained motor vehicles were analyzed. Moreover, average length of stay in hospital and number of hospital beds and bed utilization rate were involved in this analysis.

## MATERIALS AND METHODS

A retrospective and longitudinal study was conducted. Analyzed variables in this study were those in previous studies reported had statistical significant with the number of ambulance use<sup>[4,5]</sup>, as well as dummy variables represented year.

In previous studies, variables that had statistically significant with it are population and the number of household, the proportion of population aged 65 or over, average age, the population of foreigners, the proportion of livelihood protection recipients, regional health promotion measures, the proportion of health-checkups user, the number of retained motor vehicles.

Now, it explains those variables. These variables contained "number of ambulance user", "number of household", "population of aged 65 or over", "average age", "population of foreigners", "population of livelihood protection recipients", "gastric cancer examinee rate", "colon cancer examinee rate", "number of participants in regional health promotion measures", "number of beds

per 10,000 population", "Bed utilization rate", "Average length of stay", and "number of retained motor vehicles". All variables above mentioned were concerned 16 wards in Nagoya city respectively. The number of ambulance user is the annual number of people which were carried by ambulance. The proportion of aged 65 or over is the ratio of elderly people; the average age is the age of an entire population in a ward. In like manner, population of foreigners is the number of person in each ward. The proportion of livelihood protection recipients is the ratio of recipient number to an entire population in a ward. As variables in terms of the proportion of health-checkups user, proportions of examination for gastric cancer and colon cancer are used. The data about examination for lung cancer weren't used in this analysis, because the data had been changed the type of data since 2012. These examinations for gastric cancer and colon cancer, lung cancer are for inhabitants aged 40 or over. Moreover, these examinee have been subsidized once a year. The regional health promotion measures is service which involve lectures for providing information on healthcare and, supporting exchange meetings, and so on. In this study, the number of these participants was used in analysis. The number of retained motor vehicles is the sum of private car and commercial vehicle.

All of these variables were to assess the relationship with the number of patient carried by ambulance using Spearman's rank correlation coefficient. As a result of the analysis, variables which had been related to it statistically significant were analyzed using multiple regression analysis. Adopting stepwise method as variable selection, multiple regression model was gave only variables with a p value < 0.05 and removed variables with a p value > 0.10. The fit of multiple regression models was checked by use D-B ratio (Durbin-Watson ratio) and VIF (Variance Inflation Factor). The level of significance was chosen to be p < 0.05. Data analyses were performed with SAS University edition.

## RESULTS

This study included 160 data on 16wards in Nagoya city from 2004 to 2013.

**Table1. Descriptive statistics and Univariate analysis of No of ambulance user (n=160)**

Variable	Mean ± SD	median	minimum	maximum	r*	p
No of ambulance user	5653.2±1711.0	5773.5	2816.0	9294.0	NA	NA
No of households	62336.4±16386.1	64035.5	27721.0	93610.0	0.549	<0.001
Population of aged 65 or over	20.5±2.8	20.5	13.6	27.2	0.155	0.050
Average age	43.6±1.9	43.8	39.0	47.0	0.131	0.098
Population of foreigners	4006.4±1528.9	3857.5	1624.0	7932.0	0.334	<0.001
Proportion of livelihood protection recipients	16.4±8.9	14.2	4.9	43.4	0.634	<0.001
Gastric cancer examinee rate <sup>†</sup>	2.8±0.9	3.0	1.0	5.0	-0.022	0.787
Colon cancer examinee rate <sup>†</sup>	6.2±2.1	6.0	3.0	11.0	0.167	0.035
No of participants in regional health promotion measures	355.9±298.1	275.5	19.0	1766.0	0.194	0.014
No of beds per 10,000 population	1233.1±642.9	1230.6	288.0	2803.2	0.199	0.011
Bed utilization rate	79.9±6.1	80.3	60.4	103.4	-0.025	0.758
Average length of stay	37.1±41.3	24.6	15.3	272.0	0.037	0.645
No of retained motor vehicles	63177.8±19431.3	65937.5	29552.0	102239.0	-0.148	0.062

NA: Not Applicable, \* r indicates Spearman's rank correlation coefficient, † This rate to population aged 40 or over

Table1 shows mean value and SD (Standard Deviation), median, minimum, maximum, correlation coefficient, p value with it of all variable.

Results of univariate statistics showed that 6 variables had been related to the number of ambulance user. The proportion of aged 65 or over failed to show significant correlation with it (p = 0.050).

Then, using multiple regression method, relationship between the number of ambulance user as dependent variable and those 6 variables as well as dummy variables stranded for year were analyzed. As a result, all of these independent variables related to outcome statistically significant and all of dummy variables were not.

**Table2. Multiple regression analysis of No of ambulance user(n=160)**

Variable	Regression coefficient <sup>†</sup>	Standard error	t	p	VIF <sup>‡</sup>
No of households	0.490	0.030	14.64	<0.001	2.112
Populatiion of forigners	0.705	<0.001	13.07	<0.001	5.492
Proportion of livelihood protection recipients	0.445	0.044	7.89	<0.001	6.010
Colon cancer examinee rate*	-0.297	<0.001	-5.85	<0.001	4.858
No of participants inregional health promotion measures	-0.643	<0.001	-9.69	<0.001	8.301
No of beds per 10,000 population	0.270	0.024	8.13	<0.001	2.076

\* This rate to population aged 40 or over, †Standardized partial regression coefficient, ‡Variance Inflation Factor

## DISCUSSION

Six significantly variables with number of ambulance user were examined here. Increasing households was related with gain of ambulance user. As increasing households appears to grow population, it was considered ambulance use raised. Not only nuclear-family households and one-person households but also one-person elderly households of continue to be increasing in Japan. Therefore the result of multiple regression analysis showing households was significant variable was to interpret that incrementation of one-person elderly households and nuclear-family households affected strongly on dependent variable.

Because nuclear-family households increased, it was considered one-person elderly and aged-couple households grew without living together their children. Therefore suddenly getting ill or injuring, such elderly person would go to hospital by means of not his/her family's car but ambulance. As a result, it was considered that gain of households had relationship with increasing number of ambulance user.

It was suggested that number of ambulance user increased as population of foreigners gained. Earlier studies didn't find such a relationship. According to the survey report of Nagoya city<sup>[6]</sup>, South Korea/North Korea was approximately 27% and China was approximately 33% in ratio of foreigner population by nationality. To sum up, approximately half of foreigner population in Nagoya city consisted of those 3 nations. Zhang<sup>[7]</sup> guessed much of them came to Japan for employment and starting a business. If they had to receive medical care and treatment because of living low standard of life, it was suspected gain of foreigner population could explain

Standardized partial regression coefficient of variables were number of households had 0.490 (p< 0.001) and population of foreigners had 0.705 (p<0.001), proportion of livelihood protection recipients had 0.445 (p<0.001), Colon cancer examinee rate had -0.297(p<0.001), number of participants in regional health promotion measures had -0.643 (p<0.001), number of beds per 100,000 population had 0.270 (p<0.001) respectively. This multiple regression model was explained 91.6% of variation for the number of ambulance user and wasn't regarded as having no a fit of goodness because D-B ratio was 1.713 and values of VIF were from 2.076 to 8.301.

increasing of ambulance user. Hence it considers that

survey on the situation of living and the use of medical service by them was necessary.

This analysis explored that increment of proportion of livelihood protection recipients was related to increasing of ambulance user. This relationship coincides with previous study<sup>[5]</sup>. Recipients of livelihood protection were free from individual payment of medical cost in Japan. If they go to hospital because of taking ill suddenly, they weren't required to pay transport expenses by use of ambulance. On the other hand they use taxi; they need to have doctor write down about their necessity of use it to take back their money later. Therefore, it was thought that recipients of livelihood protection might have tendency to use ambulance.

Increasing number of participants in regional health promotion measures was related to more few of ambulance user. The regional health promotion measures in Nagoya city included holding of lectures and supporting group work (group discussion) on healthcare by participants. Many of participants in these measures was thought to show that there were a lot of people had high interest in healthcare. Therefore, it was considered that fewer of ambulance user because they didn't relatively get sudden illness.

Increasing rate of colon cancer examinee per population aged 40 or over was significantly related to decreasing of ambulance user. This relationship was considered to demonstrate that many people highly concerned about healthcare in a region which showed high rate of colon cancer examinee, so that ambulance use decreased because of declining in sudden illness<sup>[5]</sup>. Oshige<sup>[5]</sup> also reports that the cancer examinee rate was a significant

variable and the regression coefficient of it was negative. Consequently, the variable of cancer examinee rate is concluded evidently that had relationship with the number of ambulance user.

A lot of beds per 100,000 populations were related to increasing of ambulance user. Earlier studies didn't report such a relationship. This relationship appeared as disagreement because if there were many beds in a region, ambulance use became to decline due to increasing people who were admitted to the hospital. However, it was able to interpret this connection through understanding how to set up the number of beds in a region.

The number of hospital bed on the region is based on the system of standard number of beds regulating by Ministry of Health, Labour and Welfare (MHLW). Namely, MHLW sometimes can refuse authorization of increment beds applying by medical institution.

Emergency medicine is valuable and finite medical resource. Therefore, use of ambulance should be restricted people who are high necessity of going to the hospital urgently. If ambulance would be called excessively, it might prevent people with urgency from using it. However, the rapidly development of emergency medical system addressing about social change such as growth of aged population and incrementation of one-person households is believed. On the other hand, it is considered that the local government policy was needed to enhance the rate of health check-ups examinee because receiving medical examination makes examinees having treatment as soon as possible and prevent increasing number of ambulance user.

**Limitation of this study:** It was a retrospective one which the characteristics of data were published one by Nagoya city. More precisely study was thought to need the data were by means of a prospective survey.

## CONCLUSION

This study found that the variables related with the number of ambulance user were the number of households, population of foreigners, proportion of livelihood protection recipients, Colon cancer examinee rate, the number of participants in regional health promotion measures, number of beds per 100,000 populations. It is thought that these findings are useful for the improvement of emergency medical system by region.

**Conflict of Interest:** Nil

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