

Equity of Access to Emergency Medical Services Utilization by Elderly Koreans

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Abstract

Background Elderly adults are the demographic most likely to utilize emergency medical services (EMS). To allow for better management of EMS needs and planning, we must better understand the users' needs and break down the differences in how the various demographic subgroups of the population utilize the offered services. This study examines the extent to which equity in the use of EMS have been achieved for elderly Koreans.

Methods Using both descriptive and logistic regression analyses, this paper analyses the 2014 Korean Health Panel Survey data (n=3,175).

Results It was found that certain predisposing factors such as sex, education, and marital status were significant predictors of EMS utilization. However, differences in need do not fully account for the original differences observed between subgroups of elderly Koreans. While health status and chronic disease were important predictors of elderly Koreans using EMS, income and place of residence did not account for the subgroup differences. Nonetheless, income and place of residence remain particularly important predictors of EMS utilization for the elderly.

Conclusions The main predictors of EMS utilization by elderly Koreans include the presence of chronic disease and overall health status. Notably, though annual household income and place of residence were tested, they seem to have minimal impact on the utilization of EMS by elderly Koreans compared to factors that indicated health status and needs. In addition, the existing EMS system seems to compel certain subgroups of older Koreans (i.e., men, well-educated, married, high family income and/or people living in capital areas) to be less likely to use EMS. These predictors must be considered when modifying the EMS system to more efficiently and effectively manage already limited healthcare resources.

Background

Today, many industrialized countries are seeing rapid growth of their elderly populations as a percentage of their total populations. This issue has become exceptionally noticeable and a hot topic in the Republic of Korea (hereafter Korea) where the elderly is the fastest growing population group. The National Statistical Office states that the elderly population proportion of the total population increased from 7.2% in 2000 to 14.0% in 2017 and estimates it will reach an unprecedented 37.4% by 2050 [1][2]. Korea's rapid elderly population growth rate has surpassed even Japan, the previous record holder [3].

From previous studies, it has been proven that the elderly (aged 65 and older) are more likely to use Emergency Medical Services (EMS) than younger patients [4–7]. When viewing this in conjunction with the rapid growth rate of the elderly population, there are obvious issues that must be addressed—the most obvious being that as this population's share of the total national population increases, their health care needs are likely to create an increased financial and social burden. To allow for better management of EMS needs and planning, we must understand the users' needs and break down the differences in how the various demographic subgroups utilize the offered services. Prior studies examining EMS utilization

by the elderly have primarily focused on describing the epidemiology of injuries in elderly patients [8, 9], comparing young EMS users with elderly EMS users [10], and attempting to evaluate the appropriateness of EMS utilization [5]. However, no studies have been found that included a detailed evaluation of the differences within the elderly population subgroups and their EMS utilization.

One study has further examined factors regarding the capacity that elderly patients who are transported to an emergency medical department utilize EMS [11]. Additionally, among the elderly population there exists factors that can better help predict EMS utilization, such as symptoms of acute illness, older age, and poor social and/or physical function.

This study examines the extent to which equity has been achieved for elderly Koreans in regard to EMS. Aday-Andersen behavioral model is employed in this paper to guide the empirical and normative assessments of equity within the Korean EMS system [12, 13, 14]. This may also be a suitable model when exploratory research is needed due to lack of previous studies on service utilization, as in this study.

Methods

Conceptual Framework

For the analyses of this paper, the Aday-Andersen model [12, 13, 14] was applied (see Fig. 1). To better predict the utilization of EMS within our population, this framework was applied to define a series of predisposing, enabling, and need factors. The predisposing factor is comprised of variables regarding the propensity to utilize EMS. The enabling factor describes the means available to the individuals to use EMS. The need factor refers to the level of illness of the individual, which is also the leading variable in predicting EMS utilization [9].

The analyses further focus on the differences between the elderly population subgroups. To better analyze the extent that the differences between the subgroups can be explained by need-related (equitable) or non-need-related (inequitable) factors (Fig. 1), a series of systematic, multivariate logistic regression analyses were used.

Study Sample

This study uses cross-sectional analyses with data from the 2014 Korea Health Panel Survey (hereafter KHPS). The KHPS uses face-to-face interviews and surveys to gather data on demographics, medical expenditure, service utilization, and health behaviors of selected households. Focusing exclusively on EMS utilizations metrics, a total of 3,175 individuals were included in the study sample. The targeted sampling frame used by the KHPS was obtained from the National Population and Housing Census. To obtain a nationally representative estimate from the sample size, weights were applied to logistic regression analyses. The KHPS sampling weights are adjusted and reflect survey nonresponse and national population totals from the current population survey.

Measures

Based on the literature review, the following factors were defined. The predisposing and enabling factors included variables such as age, gender, level of educational attainment, marital status, place of residence, and income. The need and health-related factors included variables regarding health status, presence of chronic disease, and presence of a disability. The dependent variable was original binary variable reflecting whether the sample person was reported to have been to use the EMS within the previous year (coded with “yes” or “no”). For the logistic regression analysis, the independent variables were re-coded to indicate dichotomies. The first category for a variable was coded 1 and the reference category for it (after “vs.”) was coded 0. Confronting a few survey data issues, a few individuals did not provide their health status (n = 146, or 4.6% of the sample) or their household income (n = 17, or 0.5% of the sample).

Measures of health status were collected via face-to-face interview and survey and range from highly subjective (e.g., self-evaluation) to the relatively objective (e.g., conditions checked by a nursing assistant) [14]. For the study, the authors dichotomized health status measures as follows:

Self-perceived health being “poor/very poor” (1) or “fair/good/very good” (0).

Existence of a chronic disease as “no” (1) or “yes” (0).

Existence of a disability as “no” (1) or “yes” (0).

In addition to the health status of the elderly, there are a few additional demographic factors thought to be closely related to EMS utilization—particularly age and sex. However, we also wanted to include marital status. Therefore, as proxies for need in the analysis, age, sex, and marital status were respectively represented as dichotomies:

Ages “65–79” (1) or ages “80 and older” (0).

“Male” (1) or “female” (0).

“Married” (1) or “unmarried, separated, divorced, or widowed” (0).

As a supplementary measure of socioeconomic status, the paper uses the level of educational attainment, which is represented by the following dichotomy:

“high schooling or higher” (1) or “Middle schooling or less” (0).

Enabling factors included variables regarding place of residence and income. The relationship between income and care can be quite complicated, for which further examination is necessary [15]. That being said, for this paper, income refers to total for individuals if not married or the total for a couple if married with a spouse present in the same household [16]. These variables are represented by the following dichotomies:

Place of residence was represented by living in the “capital areas” (Seoul, Incheon, Gyunggi) (1) or “non-capital areas” (0).

Income was represented by salaries of “0–70 million won” (1) or salaries “over 70 million won” (0).

Analysis plan

Firstly, descriptive statistics such as mean, standard deviation (SD), percentages, and χ^2 test were used to analyze the individual features of the sample. Then, using logistic regression analysis, the relative importance of each of the factors in predicting EMS utilization was examined in more detail.

To better analyze the respective predisposing, enabling, and need-based factors as predictors of utilization, the analyses were conducted in a series of three stages.

In stage 1, the predisposing variables were analyzed to examine differences between the demographic subgroups of the elderly Korean population.

Stage 2 further analyzed the need variables to examine to what extent the subgroup differences were reduced when controlling for the variations in the need factors.

Finally, in stage 3, the researchers analyzed the enabling factors to examine whether the remaining subgroup differences were caused predominantly by the availability of EMS resources.

From this 3-stage analysis, the researchers were able to better judge how equitable EMS utilization is for the elderly.

To further explain, the measurement of the equity of EMS utilization is considered using the relative importance of need-based factors compared to the other factors (See previous studies by Park [13, 17, 18, 19] for further details).

The statistical significance of the odds ratios (the ratio of the likelihood that one age group, e.g., 65–79 years, has access compared to another age group, e.g., 80+ years) is tested to evaluate the impact of the predisposing, enabling, and need-based factors at each stage. Change in the magnitude or significance of the odds ratios in the successive stage is used to identify those factors which help account for the subgroup differences in the probability of using EMS. All tests were conducted at the 5% level of significance.

Results

Sample characteristics

The predisposing, enabling, and need characteristics along with emergency care utilization are presented in Table 1. Overall, survey respondents were more likely to have just primary/middle schooling, to be married, and to be 65-79 and male (Table 1).

The average age of the respondents was 73.9 (± 6.7) years old, with 87.69% of the respondents being female. 54.87% of the respondents were married. For educational attainment, 23.28% of the respondents had no schooling, 60.22% had primary/middle schooling, 12.22% had high schooling, and 4.28% received college education or higher. The annual family incomes ranged from 15.9 million won to 76.1 million won. More specifically, 79.12% of the respondents earned an annual family income of <20 million won,

9.04% earned 20-40 million won, 9.70% earned 40-70 million won, and 2.14% earned 70 million won or more. For area of residence, 65.13% of the respondents resided in non-capital areas while 34.87% resided in capital areas. In response to questions about self-perceived/reported and observed health, 47.21% of the respondents evaluated their health as poor or very poor, and 52.79% evaluated their health as fair, good, or very good. 76.50% of the respondents had no disability while 23.50% reported having a disability. 97.67% of the respondents had chronic diseases while 2.33% had no chronic disease.

Bivariate analysis

Those who were most likely to have used EMS were primarily those who were 65-79, were women, were unmarried/divorced/separated/widowed, had primary/middle schooling, rated their health as fair or good or very good, had no disability, had chronic diseases, lived in the non-capital area, and had a yearly family income of 0-20 million won (Table 2).

In the initial stage of the analyses, variables such as age, sex, education, marital status, income, residence, self-perceived health status, chronic disease, and disability remained significant predictors of EMS utilization. All tests were conducted at the 5% level of significance.

Multivariate analysis

The odds ratios for EMS utilization, simultaneously adjusted for multiple independent variables, are presented in Table 3. After adjusting for an array of predisposing factors (stage 1), older adults who were most likely to have utilized EMS included those who were unmarried/divorced/separated/widowed and women. Among all the predisposing variables, two variables, sex and marital status (except for age and education), were significantly associated with whether EMS was utilized.

These relationships were reexamined, adjusting for need (stage 2). Those with fair, good, or excellent health status and those who had chronic diseases were more likely to have used EMS than their counterparts.

The need variables had little impact on the subgroup differences in EMS utilization (see Table 3). The differences between demographic subgroups (those ages 65-79 versus adults over 80+, men versus women, and those who had high schooling or more versus middle schooling or less) widened in Stage 2. The predisposing factor (marital status) that exhibited non-significant effects in stage 1 became significant in Stage 2. The predisposing factor (education) which became insignificant in Stage 1 remained insignificant in Stage 2. These findings suggest health status and chronic disease remain important predictors of EMS utilization.

The impact of the enabling factors income and residence was examined in stage 3. Those with an annual family income of more than 70 million won were four and a half times more likely to use EMS than those with an annual family income of less than 70 million won. Those who lived in non-capital areas were one

and a half times more likely to use EMS than those who lived in the capital area. Adjusting for the resource variables such as place of residence and income had little impact on the odds ratios of EMS utilization for the predisposing and need factors. The predisposing factor (education) which was significant in Stage 2 became non-significant in Stage 3. The remaining subgroup differences remained about the same once the resource variables were taken into account.

In sum, income and residence did not account for the remaining subgroup differences in using EMS among older Koreans, as observed in stage 3. Nonetheless, they remain significant independent determinants of EMS utilization.

The chi-square-based test for assessing how well the models fit the data resulted in a significant result, i.e., $p < 0.0001$ (Table 3).

Discussion

This study is the first of its kind to examine the equity of EMS utilization for the elderly population in Korea. After the analysis, the results do not fully support expectations of equity in the use of EMS for the elderly. However, the results still revealed useful knowledge. The multivariate analysis revealed that health status and existence of a chronic disease were accurate predictors of EMS utilization by elderly Koreans. Also, it was found that differences in need do not fully explain the differences observed between subgroups of the elderly population. The subgroup differences (depicted in Table 3) remained relatively unchanged even after considering the resource variables. Nonetheless, income and place of residence remain important independent predictors of access to EMS. Likewise, the predisposing factors such as sex, education, and marital status were also found to be significant predictors of EMS utilization by elderly Koreans.

The study further determined that in Korea, those fitting the demographic profile of being unmarried/divorced/separated/widowed women who have only a primary/middle school education were most likely to utilize EMS. This result is also consistent with those of previous studies [14, 17]. Going off of the research of Rucker and colleagues who examined predictors of EMS utilization among all adults in the population and found that age and physical functional capability were not necessarily associated with an increased likelihood of using EMS [11]. This paper further examines one flaw found in their methods, which is that they did not examine the elderly population separately from just general “adults”. In addition, they did not isolate elderly patients admitted to a university hospital emergency department as an important and vulnerable subgroup in the population that requires further evaluation. Similar to previous studies, the researchers found that family income and place of residence is positively associated with EMS utilization [14].

This study further contributes to the existing literature on equity in EMS utilization. To the knowledge of the researchers, this study is the first to examine, in detail, the equitability of the EMS for elderly Koreans on a national level. Post literature review, the researchers were able to define various predisposing, enabling, and need-based variables associated with EMS utilization. These variables built the model to

further evaluate fairness in the use of EMS by elderly Koreans based on the relative importance of need compared to other defined factors of EMS utilization.

A few limitations of our paper require mentioning. Primarily, our analysis model was limited to only the data collected by the 2014 Korea Health Panel Study. Therefore, there are natural difficulties that arise with using secondary data in an analytical model. In terms of the study design, none of the established observations in the panel data can be inferred as having a cause-effect relationship. The majority of data were self-reported; however, the surveyors did allow for proxy responses in situations where the family member was not home or if the respondent was a child or unable to provide their own responses due to either physical or mental handicaps. No matter the efforts to promote accurate reporting, the responses still face the natural risk of being inaccurate due to the respondent being unaware of relevant information or choosing to not respond due to privacy concerns.

Conclusions

The main predictors of EMS utilization by elderly Koreans include the presence of chronic disease and general overall health status. While annual household income and place of residence were tested, they seem to have minimal impact on the use of EMS by elderly Koreans compared to other factors present that indicate health status and needs. In addition, it was found that the demographic subgroup profile of well-educated married men with higher incomes living in the capital area are the least likely to utilize EMS. These predictors are useful when considering modifications to the EMS system to more efficiently and effectively manage already limited healthcare resources in Korea.

Declarations

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Availability of data and materials

The dataset supporting the conclusions of this article is available in the the 2014 Korea Health Panel Survey (KHPS), <https://www.khp.re.kr:444/web/data/data.do>.

Authors' contributions

JMP developed the original research ideas, designed the study, obtained the data, conducted data analysis, interpreted the results, and wrote and revised the manuscript. AS helped discuss the results. DM made critical revisions and finalized the manuscript. All authors read and approved the final manuscript.

Ethics approval and consent to participate

This research uses data from the 2014 KHPS. The KHPS Review Board granted an exemption for this research. All participants provided written informed consents for their participation in the survey.

Consent for publication

Not applicable.

Competing interests

The authors declare there are no competing interests.

Abbreviations

Korea
The Republic of Korea
EMS
Emergency Medical Services
KHPS
Korea Health Panel Survey
SD
Standard Deviation
CI
Confidence Interval
EXP
Exponential
US
United States
KRW
Korea Won

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Tables

Table 1. Descriptive Characteristics of the Sample (N=3,175)

Variables	N(%)	Mean(\pm SD)
Predisposing:		
Age group (years)		73.9(\pm 6.7)
65-79	2,188(68.91)	
80+	987(31.09)	
Sex		
Male	391(12.31)	
Female	2,784(87.69)	
Education		
No schooling	739(23.28)	
Primary/Middle schooling	1,912(60.22)	
High schooling	388(12.22)	
College schooling +	136(4.28)	
Marital status		
Married	1,742(54.87)	
Others	1,433(45.13)	
Need:		
Health status		
Poor	1,430(47.21)	
Fair+	1,599(52.79)	
Disability		
Yes	746(23.50)	
No	2,429(76.50)	
Chronic disease		
Yes	3,101(97.67)	
No	074(2.33)	
Enabling:		
Income (million won)		493,765(\pm 159,822)
0-20	2,512(79.12)	
20-40	287(9.04)	
40-70	308(9.70)	
70+	68(2.14)	
Residence		
Capital area	1,107(34.87)	
Non-capital area	2,068(65.13)	

Table 2. Percentage of those who used emergency services by each variable.

Study Variables	Emergency care utilization	
	Percentage	χ^2
Predisposing:		
Age (years)		8.75 ^a
65 -79	44.19	
80+	21.61	
Sex		164.73 ^a
Male	11.65	
Female	54.14	
Education		16.38 ^a
No schooling	13.92	
Primary/Middle schooling	40.47	
High schooling	8.35	
College schooling +	3.06	
Marital status		217.45 ^a
Married	29.92	
Others	35.87	
Need:		
Self-perceived health status		149.27 ^a
Poor	25.49	
Fair+	39.68	
Disability		21.18 ^a
No	48.69	
Yes	17.10	
Chronic disease		82.75 ^a
Yes	65.42	
No	0.38	
Enabling:		
Income (million won)		122.43 ^a
0-20	55.35	
20-40	4.84	
40-70	5.26	
70+	0.70	
Residence		9.68 ^a
Capital area	24.19	
Non-capital area	41.61	

a: $p < .01$

Source: Korean Health Panel Survey (2014).

Note: The number of cases on which the estimates are based is 3,175, except for the following variable (for which the number of cases is noted in parentheses): self-perceived health status (3,158), household income (3,029).

Note: The coefficient in logistic regression, b_k implies every one-unit increase in the variable increases the odds of contact with a doctor by a factor of EXP (b_i). The sign of b_k reflects the direction of the effect in the logistic regression.

Table 3 - Multivariate logistic regression analysis of predictors of emergency care utilization for Korean Elders, weighted (2014)

Determinants	Emergency care utilization					
	Stage I		Stage I		Stage III	
	Odds ratio (95% CI)	p	Odds ratio (95% CI)	p	Odds ratio (95% CI)	p
Predisposing:	0.992	0.930	0.829	0.05	0.848	0.09
Age group (years)	(0.829-1.187)		(0.684-1.005)		(0.698-1.029)	
65 -79						
80 +	0.095	<0.01	0.075	< 0.01	0.072	<0.01
	(0.060-0.149)		(0.046-0.122)		(0.044-0.118)	
Sex						
Male						
Female	0.869	0.209	0.753	<0.05	0.829	<0.01
	(0.698-1.082)		(0.589-0.963)		(0.643-1.068)	
Education						
High schooling +						
Middle schooling or less	3.249	<0.01	4.016	<0.01	4.136	<0.01
	(2.739-3.853)		(3.333-4.838)		(3.425-4.994)	
Marital status						
Others						
Married						
Need:						
Health status			0.338	<0.01	0.361	<0.01
Poor			(0.284-0.402)		(0.303-0.430)	
Fair+						
Disability			1.050	0.650	1.092	0.422
No			(0.849-1.299)		(0.881-1.354)	
Yes						
Chronic disease			0.081	<0.01	0.064	<0.01
No			(0.036-0.183)		(0.028-0.147)	
Yes						
Enabling:					0.22	<0.01
Income (million won)					(0.121-0.399)	
0-70						
70+					0.645	<0.01
					(0.534-0.778)	
Residence						
Capital area						
Non-capital area	23.77		649.730		690.430	
Model chi-square	4		7		9	
Degree of freedom	<0.0001		<0.0001		<0.0001	
Significance						

Korean monetary unit (\$US 1= KRW 1,150).

Source: Korean Health Panel Survey (2014).

Figures

MEDIATING VARIABLES

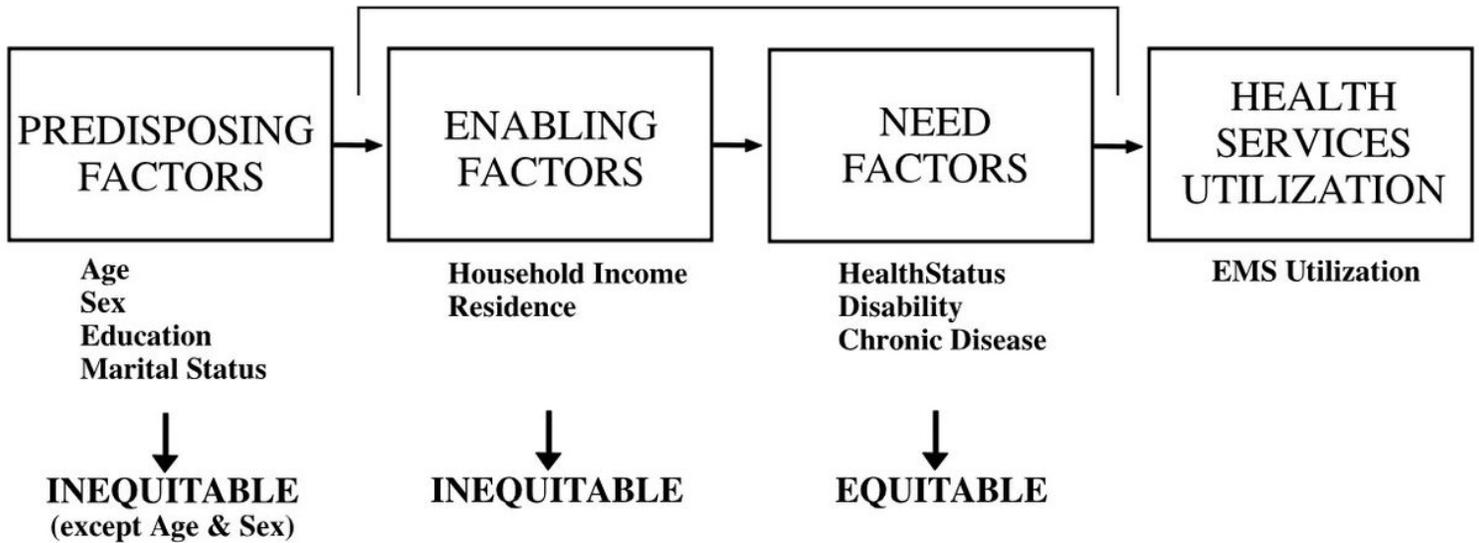


Figure 1

Conceptual framework for this study. The enabling and need factors are mediating variables that help to explain differences between subgroups that might be due to either equitable (need) or inequitable (enabling) factors. Age and sex serve as proxies for need because of the well-established relationships between illness patterns and age and sex. Other predisposing variables are, however, inequitable factors