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ORIGINAL ARTICLE

한국의 의료기관 외래진료 민감질환 입원율: 의료이용 효율성 지표로의 활용 가능성?

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Hospital Admission Rates for Ambulatory Care Sensitive Conditions in South Korea: Could It Be Used as an Indicator for Measuring Efficiency of Healthcare Utilization?

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Background: Hospital admissions for ambulatory care sensitive conditions (ACSCs), which are widely used as an indicator of poor access to primary care, can be used as an efficiency indicator of healthcare use in countries providing good access to health care. Korea, which has a national health insurance (NHI) system and a good supply of health care resources, is one such country. To quantify admission rates of ACSC and identify characteristics influencing variation in Korean health care institutions.
Methods: By using NHI claims data, we computed the mean ACSC admission rate for all institutions with ACSC admissions.
Results: The average ACSC admission rate for 4,461 institutions was 1.45%. Hospitals and clinics with inpatient beds showed larger variations in the ACSC admission rate (0%-87.9% and 0%-99.6%, respectively) and a higher coefficient of variation (7.96 and 2.29) than general/tertiary care hospitals (0%-19.1%, 0.85). The regression analysis results indicate that the ACSC admission rate was significantly higher for hospitals than for clinics ($\beta = 0.986$, $p < 0.05$), and for private corporate institutions than public institutions ($\beta = 0.271$, $p < 0.05$).
Conclusion: Substantial variations in ACSC admission rates could suggest the potential problem of inefficient use of healthcare resources. Since hospitals and private corporate institutions tend to increase ACSC admission rates, future health policy should focus on these types of institutions.

Keywords: Ambulatory care sensitive conditions; Efficiency; Delivery of health care; Utilization

INTRODUCTION

Conceptualized by Billings et al. [1] in the early 1990s, ambulatory care sensitive conditions (ACSC) such as hypertension, diabetes, chronic heart failure, chronic obstructive pulmonary disease, and asthma are defined as health conditions for which hospitalization can be avoided by timely and effective primary care in outpatient settings [2]. Thus, high hospitalization rates for ACSC for certain geographic regions or populations have been widely considered an indicator of poor access to primary care arising from factors such as low socioeconomic status, few healthcare professionals providing primary care, and a lack of health insurance [3-6].

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However, in the health care system providing good access to primary care, ACSC admissions may not represent a lack of primary care. Korea, which has a national health insurance (NHI) system and a good supply of health care resources, is an example. Korea instituted a national and universal health insurance (NHI) system in 1989, which has improved access to primary care in the country. An increase in the supply of healthcare providers across the country along with economic growth has reduced variations in access to primary care across population groups and regions. In this regard, ACSC admissions in Korea may be used not as an indicator of poor access to primary care but as an indicator of the inefficient or unnecessary use of healthcare resources.

Evidence supporting inefficient use of health care resources in Korea has been cumulated. Firstly, one of the distinctive features in Korean health care delivery system is that the concept of primary care physicians as gatekeepers hardly exists [7]. Thus, although access to primary care is good in Korea, the lack of gatekeeping role of primary care providers may not play an expected role to prevent ACSC admissions. Patients choose their providers and the level of care they believe they need. Korean general and tertiary care hospitals provide all levels of care from primary to tertiary care, and they are paid by a fee-for-service payment system. Under a prospective payment system for inpatient care, healthcare providers have a strong incentive to provide patient care under outpatient settings to minimize the use of resources for inpatient care [8,9]. On the other hand, healthcare providers who are paid under a fee-for-service payment system are likely to emphasize inpatient care because inpatient care has a greater potential to generate more services relative to outpatient services and thus more profits for providers.

Secondly, previous studies have found some inefficiency in healthcare use in Korea. For example, Korea offers more healthcare resources than other industrialized countries, raising concerns that healthcare services may be overused through induced demand [10,11]. For example, the number of hospital beds per 1,000 population in Korea in 2007 (9.3) was 1.6 times the average for the Organization for Economic Cooperation and Development (OECD) countries (5.7), 3.0 times that for the US (3.1), and 2.7 times that for the UK (3.4) [12]. In addition, the numbers of magnetic resonance imaging units and computed tomography scanners per million population in Korea in 2007 were 16.0 and 37.1, respectively, which were 1.6 and 1.8 times the OECD averages [13].

Also, previous empirical studies in Korea have highlighted the problem of providing inappropriate care and employing expensive types of healthcare services [12,14,15]. An examination of a university-affiliated hospital in Korea revealed that approximately 21.7% of its admissions were medically inappropriate [15]. Another study reported that major reasons for inappropriate inpatient days of a study hospital are cases relevant to be treated in outpatient care setting (64.0%), premature hospital admission (17.4%), or inpatient days wasted due to waiting for diagnostic tests with a long waiting list (11.6%) [16]. In addition to these findings, the rapid rise in healthcare spending in Korea has increased the demand for a better understanding of the factors influencing the unnecessary or inefficient use of healthcare resources.

In this regard, this study quantifies the ACSC admission rate for individual health care institutions in Korea to provide important insights into the potential problem of the inefficient use of healthcare resources in the context of ACSC admissions. In addition, the study identifies the factors influencing variation in ACSC admission rate across health care institutions to provide important policy implications.

METHODS

1. Defining Korean Ambulatory Care Sensitive Conditions

In general, the types of health conditions classified as ACSCs are influenced by practice patterns under a particular healthcare system. Therefore, the common practice is to use a country-specific list of ACSCs that modifies the original US version of 22 ACSCs for each country [17,18]. We consulted a panel of Korean clinicians representing various specialties such as gastroenterology, respiratory medicine, neurology, pediatrics, and nephrology. Based on the consultation, we excluded those ACSCs that are generally treated through inpatient care, including congenital syphilis, immunization-related and preventable conditions, bacterial pneumonia, and diabetes A. In addition, we excluded dental conditions because almost all dental cases are treated through outpatient care in Korea. As a result, we obtained a total of 14 conditions for Korean ACSCs (KACSCs) [19] (Table 1).

2. Study Subjects and Data Sources

Major data source of the study was the national health insurance (NHI) claims data in 2004. Study subjects include health care institutions that have filed any inpatient or outpatient insurance claims of KACSCs as a primary diagnosis in 2004. We initially identified a total of 4,469 institutions but excluded those with only

Table 1. List of ACSCs

Conditions	ACSCs defined by the Institute of Medicine		Korean ACSC
	ICD-9-CM codes	Comments	Include or exclude
Congenital syphilis	90	Secondary diagnosis for newborns only	Exclude (-)*
Immunization -related and preventable conditions	032.0, 033, 037, 045, 390, 391	Hemophilus meningitis (ages 1-5 only)	Exclude (-)*
Grand mal status and other epileptic convulsions	345		Include
Convulsions 'A'	780.3	Age 0-5	Include
Convulsions 'B'	780.3	Age >5	Include
Severe ENT (ear, nose, and throat) infections	382, 462, 463, 465, 472.1	Exclude otitis media cases (382) with myrigotomy with tube insertion (20.01)	Include
Chronic obstructive pulmonary diseases	491, 492, 494, 496, 466.0	Acute bronchitis only with the secondary diagnosis of 491, 492, 494, or 496	Include
Bacterial pneumonia	481, 482.2, 482.3, 482.9, 483, 485, 486	Exclude cases with the secondary diagnosis of sickle cell anemia (282.6) and patients <2 months	Exclude (-)*
Asthma	493		Include
Congestive heart failure	428, 402.01, 402.11, 402.91, 518.4	Exclude cases with surgical procedures (ICD-9 codes: 36.01, 36.02, 36.05, 36.1, 37.5, and 37.7)	Include
Hypertension	401.0, 401.9, 402.00, 402.10, 402.90		Include
Angina	411.1, 411.8, 413	Exclude cases with surgical procedures (01-86.99)	Include
Cellulitis	681-3, 686	Exclude cases with surgical procedures (ICD-9 code: 01-86.99), except incision of skin and subcutaneous tissue (86.0) where it is the only listed surgical procedure	Include
Skin grafts with cellulites	DRGs 263, DRGs 264	Exclude skilled nursing facility/intermediate care facility admissions	Exclude (+/-)*
Diabetes 'A'	250.1-3		Exclude (-)*
Diabetes 'B'	250.8-9		Exclude (+/-)*
Diabetes 'C'	250		Include
Hypoglycemia	251.2		Include
Gastroenteritis	558.9		Include
Kidney/urinary tract infections	590, 599.0, 599.9		Include
Dehydration-volume depletion	276.5	Examine principal and secondary diagnoses separately	Exclude (+/-)
Dental conditions	521-3, 525, 528		Exclude (+)*

From Institute of Medicine et al. Access to health care in America. Washington (DC): National Academy Press; 1993, with permission from National Academy Press [19].
ACSC, ambulatory care sensitive conditions; ICD-9-CM, International Classification of Diseases, 9th revision, clinical modification; DRGs, diagnosis related groups.
*Reasons for exclusion: (-) mostly inpatient care, (+) mostly outpatient care, and (+/-) equally likely to provide inpatient/outpatient care.

inpatient claims for ACSC cases (n=8). We considered these institutions as outliers because health care institutions are not likely to treat all ACSC cases through inpatient care. Thus, the final sample included 4,461 institutions.

We used the health care institution file from the NHI data to examine the characteristics of each institution, including the level of care, the location, and the type of ownership. We also employed national census data for the demographic and socioeconomic characteristics of each region. For the regional characteristics, we considered a total of 234 regions (e.g., cities, counties, and municipal districts) based on zip codes.

3. Variables

We operationalized the ACSC admission rate for a given institution as the ratio of ACSC inpatient admissions to all ACSC cases (i.e., the sum of all ACSC admissions and outpatient visits) for a given year:

$$\text{ACSC admission rate}_i = \frac{\text{Number of ACSC inpatient admissions}_i}{\text{Total ACSC cases}_i} \times 100$$

where $i = 1, \cdots, n^{th}$ health care institution

We selected population, regional, and institutional characteristics as the independent variables for the multivariate model to explain the variation in the ACSC admission rate. The variables for population characteristics included demographic and socioeconomic characteristics of residents living in regions where institutions are located, such as the sex ratio (i.e., male to female), the age index, the education level of the population, and the financial in-

dependence of the region. Each institution is assigned to one of the 234 administrative districts (e.g., cities, counties, and municipal districts) based on its zip code. We measured the age index by the proportion of individuals aged 65 and over and the education level by the proportion of college graduates. Financial independence of a region reflects affordability of the residents for health care services, which was defined as the proportion of local tax and nontax revenue to the general tax revenue of local government.

For regional factors, we considered the availability of healthcare resources in the region. Regional factors are defined as the number of primary care clinics and the number of hospital beds in the region. The availability of healthcare resources may have positive or negative effects on the use of inpatient services. We assumed that an increase in the number of primary care providers would enhance healthcare access and reduce the likelihood of ASCS admissions, and that an increase in the supply of hospital beds would increase hospital admissions.

Finally, organizational characteristics were described by the level of care and the type of ownership. We assessed the level of care by considering the following three categories: (1) clinics with inpatient beds, (2) hospitals, and (3) general/tertiary care hospitals. Under the Korean Medical Law, ambulatory clinics can have inpatient beds. We assumed that the higher level the institution is, the more complex and severe its patient case-mix would be. Lastly, institution ownership was classified as public, private corporate, and private non-corporate institutions.

4. Data Analysis

We computed the mean ACSC admission rate to observe the magnitude of inpatient services provided to treat ACSC patients in Korea. In order to determine the extent and characteristics of variation among the study institutions, the range and coefficient of variation (CV) of the ACSC admission rate were examined for all institutions and the subgroups of institutions according to the level of care. The CV is defined as the standard deviation divided by the mean ACSC admission rate, that is, the higher the CV, the greater the variation. Also, funnel plots were performed for graphical presentation of the variation.

Multivariate ordinary least squares regression analyses were conducted to assess the effect of organizational and regional characteristics on the ACSC admission rates of individual institutions. The model I was specified to include population factors only (i.e., demographic and socioeconomic characteristics). The model II extended to include regional factors (i.e., health care resources). For model III, the full model, we added organizational characteristics. We took the natural log of the ACSC admission rate to reduce the effects of outliers. To prevent missing values assigned to institutions with no ACSC admissions as a result of the log transformation, we added 1% to the ACSC admission rate before taking the natural log. We analyzed the data by Stata ver. 8.1 (Stata Co., College Station, TX, USA).

RESULTS

The average ACSC admission rate for the 4,461 study institutions was 1.45% (standard deviation [SD] = 6.74). The mean ACSC admission rates varied across the institutions according to the level of care: They were 0.38% (SD = 3.01) for clinics with inpatient beds, 6.42% (SD = 14.71) for hospitals, and 3.05% (SD = 2.59) for general/tertiary care hospitals (Table 2). Clinics and hospitals showed large variations in the ACSC admission rate (0%-87.9% and 0%-99.6%, respectively) and high CV values (7.96 and 2.29, respectively). However, general/tertiary care hospitals showed small variations and a low CV value (0%-19.1%, 0.85). On the funnel plots, all of the three types of institutions had data points outside of the control limits (i.e., 95% confidence interval and 99.8% confi-

Table 2. Admission rates of ACSCs for Korean health care institutions

	No. of institutions	Mean % ± standard deviation	Min %-Max %	CV*
Overall	4,461	1.45 ± 6.74	0-99.62	4.64
Level of care				
Clinics with inpatient beds	3,530	0.38 ± 3.01	0-87.91	7.96
Hospitals	683	6.42 ± 14.71	0-99.62	2.29
General/tertiary care hospitals	248	3.05 ± 2.59	0-19.13	0.85

Under the Korean Medical Law, ambulatory clinics can have inpatient beds. ACSC admission rate = (ACSC inpatient admissions/total ACSC cases) × 100.
ACSCs, ambulatory care sensitive conditions; CV, Coefficient variation.
*CV = standard deviation/mean.

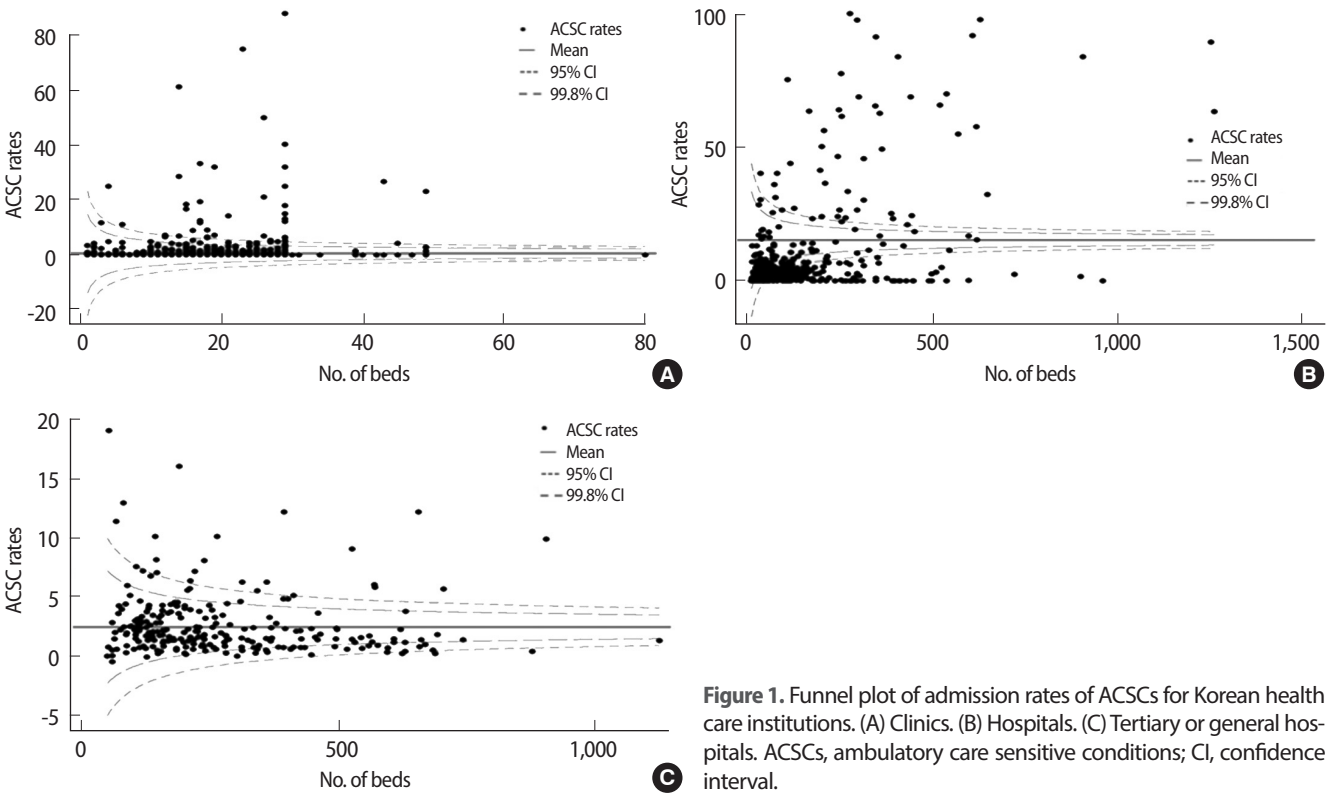

Figure 1. Funnel plot of admission rates of ACSCs for Korean health care institutions. (A) Clinics. (B) Hospitals. (C) Tertiary or general hospitals. ACSCs, ambulatory care sensitive conditions; CI, confidence interval.

Table 3. Regression analysis results of factors associated with ambulatory care sensitive condition admission rates of Korean health care institutions

	Model I		Model II		Model III	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Population characteristics						
Demographic characteristics						
Sex ratio	0.002	0.003	0.005	0.004	0.007*	0.003
Age index	0.013	0.003	0.023	0.004	0.012**	0.003
Education level	0.001	0.001	-0.001	0.001	0.001	0.001
Financial condition						
Proportion of households with a car			0.003	0.002	0.001	0.001
Financial independence			0.001	0.001	-0.001	0.001
Regional characteristics						
Healthcare resources per 1,000						
No. of hospital beds			0.064**	0.017	0.039*	0.013
No. of primary care clinics			-0.087	0.069	-0.091	0.060
Organizational characteristics						
Ownership type						
Public (reference)						
Private corporate					0.271*	0.119
Private non-corporate					-0.003	0.119
Level of care						
Clinics with inpatient beds (reference)						
Hospitals					0.986*	0.038
General/tertiary care hospitals					0.968*	0.052
Adjusted R-squared	0.02		0.03		0.43	

Seven regional dummies (Seoul [capital city] and 6 provinces [Gyeonggi-do, Gangwon-do, Gyeongsang-do, Jeolla-do, Chungcheong-do, Jeju-do]) were included to control for unknown regional differences.
SE, standard error.
*$p<0.05$. **$p<0.01$.

dence interval), indicating that the variation is not natural or random variation, but special cause variation (Figure 1) [20,21]. Thus, the cause of the variation would be worth for further investigation.

We conducted a multivariate regression analysis to determine the factors influencing these variations. The results for the adjusted R-squared for models I and II indicate marginal explanatory power (0.02 and 0.03, respectively). For model III, the adjusted R-squared was 0.42. We calculated variation inflation factor (VIF) to examine whether a variable is highly correlated with other variables in the model. A general rule is that VIF should not exceed 10 [22]. The VIF results for model III were less than 10. Thus, we adopted model III to examine the effects of various factors on the ACSC admission rate.

The results for model III indicate that organizational characteristics were significant predictors of the ACSC admission rate. The ACSC admission rate was significantly higher for hospitals and general/tertiary care hospitals than for clinics with inpatient beds ($\beta = 0.986$ and $\beta = 0.968$, respectively; $p < 0.05$). In addition, this rate was significantly higher for private corporate institutions than for public institutions ($\beta = 0.271$, $p < 0.05$). Among the population characteristics, the sex ratio and the age index were significant predictors of the ACSC admission rate. An increase in the sex ratio or the age index led to an increase in the ACSC admission rate. Among the regional factors, the number of hospital beds was the only significant predictor of the ACSC admission rate. As more beds are available in a region, the ACSC admission rates of institutions increased ($\beta = 0.271$, $p < 0.05$) (Table 3).

DISCUSSION

The mean ACSC admission rate of Korean health care institutions was calculated as 1.45%. Its implication is not straightforward to tell whether this is high enough to bring an attention because of the following reasons. First, no objective criterion has been proposed to judge how high the ACSC admissions rate is problematic. Second, we cannot compare the result directly with the rates for other countries because the ACSC admission rate for other countries is typically calculated based on a unit of analysis such as the geographic region (e.g., the ACSC admission rate per 1,000 population), not on the health care institution, as in this study. For instance, avoidable hospitalization in the US in terms of ACSCs was 133.8 per 10,000 population in 1998 [5], and 34% of all inpatient admissions occurred in California [23]. The chronic obstructive pulmonary disease admission rate for Australia ranged from 1.36 to 2.84 per 1,000 population [24]. The ACSC admission rate accounted for 31.5% of all admissions in an acute care hospital in Italy [25]. Finally, the conditions included in KACSCs differed from those in the US version of ACSCs or in country-specific ACSCs because we modified the list of KACSCs to reflect the patterns of ACSC treatment in Korea.

However, we found substantial variations in the ACSC admission rate across the health care institutions, which indicate the possible overuse of inpatient services for ACSCs. The regression analysis results indicate that organizational characteristics were a significant predictor of variations in the ACSC admission rate. The results of stepwise modeling verify the regression results. The model's explanatory power increased sharply from 0.03 to 0.42 through the addition of organizational factors to population and regional factors.

The level of care and the ownership type had significant coefficients, further demonstrating the effects of organizational characteristics on the ACSC admission rate. The ACSC admission rate was higher for those institutions providing a high level of care (i.e., hospitals and general/tertiary care hospitals) than for those providing a low level of care (i.e., clinics with inpatient beds) ($p < 0.005$). These results are consistent with the findings of previous studies [26-28].

Noteworthy is that general/tertiary care hospitals showed small variations (CV = 0.85), whereas hospitals showed large variations (CV = 2.29). Because patients with severe conditions tend to seek a higher level of care, the patient case-mix, not the pattern of an institution's clinical practices, may explain the small variations in the ACSC admission rate for general/tertiary care hospitals. On the other hand, the large variations in the ACSC admission rate for hospitals indicate the possibility of the use of unnecessary inpatient care and provide support for the inefficient use of healthcare resources in Korea. The type of ownership, an organizational characteristic, explained some of the variations in the ACSC admission rate. Private corporate institutions had significantly higher ACSC admission rates than did national/public institutions ($p < 0.05$). This result is not surprising because these private institutions accounted for a large portion of hospitals (42.0%).

Population characteristics influenced the use of inpatient care for ACSC patients. Health care institutions in regions with high proportions of males and older individuals were more likely to show high ACSC admission rates. Previous studies have produced

mixed results for gender differences in healthcare use. Some have reported that females are more likely to use healthcare services, whereas others have reported the opposite [2,29,30]. The results for the age effect on the use of inpatient care are consistent with the findings of previous studies [31,32].

Previous studies have typically used the ACSC admission rate as an indicator of healthcare access and suggested that better access to primary care reduces the ACSC admission rate [3-6]. The present study's results do not provide support for this rationale. The number of primary care clinics per 1,000 population was not significantly related to the ACSC admission rate. On the other hand, the number of hospital beds per 1,000 population had a significant positive effect on the ACSC admission rate, which suggests the potential behavior of inefficient use of hospital resources and unnecessary hospital admissions.

This study has some limitations. First, because of limited access to patient-level data from NHI records, we employed demographic and socioeconomic characteristics of residents in regions where health care institutions were located as proxies for population factors. Second, for the same reason, we could not control for differences in the patient case-mix across institutions in the multivariate analysis, which otherwise would have increased the validity of the findings.

The result of the present study supports the potential problem of inefficient use of health care resources of Korean health care system, which can be characterized as NHI scheme with fee-for-service reimbursement system, lack of gatekeeping, primary and secondary care co-located, and lack of organizational barrier. It is hard to conclude which characteristics of the Korean healthcare system are attributable to the problem. However, it is hoped that the result of this study can be utilized to emphasize the need for an appropriate health policy to improve the efficient use of health care resources in Korea.

In sum, we examined the potential problem of the inefficient utilization of healthcare resources in Korea using annual mean ACSC admission rate of individual health care institutions in this study, with an assumption that a high ACSC admission rate could be a signal for the possibility of unnecessary or preventable utilization of inpatient care. Also, a wide variation of the mean ACSC admission rates among institutions could be considered as an indication that some health care providers may over-utilize inpatient services. However, this approach has a limitation in general application so it's utilization should be confined to areas or countries with a competitive supply of healthcare providers and low financial barriers to healthcare utilization such as South Korea.

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