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Relevance Index Regional Variation by Each Disease and Its Essential Medical Field: A Retrospective Data Analysis From 2016-2020 in Korea

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ABSTRACT

Background: To precisely build a healthcare delivery system at regional levels, local patients' healthcare service utilization patterns must be examined. Hence, this study utilized trend analysis of the relevance index of each disease of each essential medical service field at the municipal and provincial levels.

Methods: This study analyzed customized databases released by the National Health Insurance Service from 2016–2020. Diseases defined in the Korean National Burden of Disease (KNBD) study were categorized into the following essential medical service fields: trauma care, cardiocerebrovascular, maternal and neonatal, mental health, infection, cancer, older adults' care and rehabilitation, and others. Relevance index, the percentage of medical service utilization in a region by the residents of that region relative to their total medical service utilization, was examined by region (17 municipal and provincial regions) and disease area. The relevance index was determined based on the number of patients and the total out-of-pocket expenses.

Result: Eight of the 17 regions showed over a 90.0% relevance index in the infection area. In the cancer area, 14 regions (not including Seoul, Daegu, and Busan) had a relevance index lower than 75.0%. Throughout the analysis period (2016–2020), there were no significant variations in the relevance index. Diseases such as bone and connective tissue cancer (39.0%), neural tube defects (16.7%), and autism (57.1%) had low relevance index in the essential medical service fields. In all 17 regions, the relevance index of inpatients was lower than that of outpatients, and that for out-of-pocket expenses was lower than that based on the number of patients.

Conclusion: The relevance index of major diseases of each essential medical service field calculated in this study can provide good indicators for monitoring the level of an independent regional healthcare delivery system.

Keywords: Relevance Index; Essential Medical Service; Public Healthcare; National Burden of Disease

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Disclosure

The authors have no potential conflicts of interest to disclose.

Author Contributions

Conceptualization: Kim YE, Pyo J, Ock M, Yoon SJ. Data curation: Kim YE, Pyo J, Lee H, Jeong H, Park YK, Seo JW, Ock M. Formal analysis: Park YK, Seo JW, Ock M. Funding acquisition: Ock M, Yoon SJ. Investigation: Kim YE, Pyo J, Ock M. Methodology: Kim YE, Pyo J, Ock M, Yoon SJ. Project administration: Ock M, Yoon SJ. Software: Lee H, Jeong H. Supervision: Ock M, Yoon SJ. Validation: Kim YE, Pyo J, Lee H, Jeong H, Ock M. Visualization: Pyo J, Lee H, Jeong H, Park YK, Seo JW. Writing - original draft: Kim YE, Pyo J, Ock M. Writing - review & editing: Kim YE, Pyo J, Lee H, Jeong H, Park YK, Seo JW, Ock M, Yoon SJ.

INTRODUCTION

Despite efforts to reduce the health inequalities among Korean regions, regional health inequalities still exist. For example, a comparison of the age-standardized mortality rates among the 17 municipal and provincial regions (hereafter “17 regions”) shows no significant changes over time in the disparities between the regions showing the highest and lowest mortality rates.¹ Regarding the regional health inequalities for healthy life expectancy, differences between the regions showing the highest and lowest health-adjusted life expectancy and quality-adjusted life expectancy, which are widely used measures of healthy life expectancy,² are 3.2 and 4.6 years, respectively.^{3,4} Another study found that the regional disparity in health-adjusted life expectancy increased from 4.9 years in 2008 to 5.7 years in 2008.⁵

Among many causes of regional health inequalities, one is the situation wherein residents in a region cannot receive the essential medical services when health needs arise.⁶ This requires not only the existence of medical institutions that can provide essential medical care, but also the need to consider the existence of medical institutions that can satisfy the preferences of local residents. Therefore, whether a local community has the infrastructure required for a good delivery of essential medical services, which is closely related to life and has a decisive influence on health-related quality of life, must be examined. The Korean government is recently attempting to position a healthcare delivery system in each region with the Public Healthcare Network Plan and Regional Healthcare Promotion Plan.^{7,8} As a part of such efforts, they began to designate and operate competent medical institutions (so-called “Accountable Care Hospital”) in 17 regional and 70 subregions across the country.⁹ Designated medical institutions provide high-quality medical services in the essential medical fields, including trauma care, cardiocerebrovascular, maternal and neonatal, mental health, infection, cancer, and older adults’ care and rehabilitation areas at the regional and local levels.

However, the most significant in a precise regional healthcare delivery system structure is examining how local patients use healthcare services, which is the relevance index status. The data on patients’ regional healthcare service utilization patterns provide a crucial evidential basis for assembling regional and local leading medical institutions’ concrete roles and building additional ones. In Republic of Korea (hereinafter Korea), studies on relevance index have been reported in some diseases or disease areas,¹⁰⁻¹² but they do not consider the trend analysis of relevance index of the diseases in the essential medical service fields. Park et al.¹³ attempted to analyze the relevance index trends, but it was limited to one region (Ulsan Metropolitan City).

To bridge this research gap, this study aimed to analyze the trends of relevance index by region and disease in each essential medical service field. Furthermore, this study intended to broaden the scope of relevance index analysis by classifying relevance index according to service utilization type (inpatient and outpatient) and unit (number of patients and total out-of-pocket expenses).

METHODS**Essential medical service fields and disease classification**

The definitions for essential medical services are varied.¹⁴ The Public Health and Medical Services Act defines the term “public health and medical services” as “all activities of the

State, local governments, and public and medical institutions to ensure all citizens equal access to medical services and to protect and promote their health.”¹⁵ This study is based on the definition and the disease classification system used in the Korean National Burden of Disease (KNBD) study,^{16,17} which provides a basis for prioritizing interventions between diseases using an indicator of disability-adjusted life-years (DALYs). With reference to the disease classification system of the KNBD study, we divided the essential medical services into eight areas: trauma care, cardiocerebrovascular, maternal and neonatal, mental health, infection, cancer, older adults' care and rehabilitation, and others. A total of 260 diseases defined as diagnostic codes¹⁷ in the diseases used in the KNBD study were re-classified into the eight essential medical service fields as in a previous study.¹³ A complete list of diseases and their classification into essential medical service fields are presented in the supplementary file (**Supplementary Table 1**).

Data source

This study used customized databases of the National Health Insurance for analysis.¹⁸ Considering the size of the analysis data, the analysis period is limited to 2016 to 2020. After classifying the datasets for annual inpatient and outpatient medical service utilization (claim) of each patient, those for medical or dental clinics and hospitals, and public health institutions were selected for analysis; those for oriental medical institutions were discarded. The data source used for relevance index analysis included the address, medical institution used, and the diagnostic code information for the disease definition of each patient.

Relevance index analysis

The relevance index refers to the percentage of residents' medical service utilization in a region relative to their total medical service utilization.¹⁹ This suggests the residents' preference for a specific region for their medical institutions and is often used as an indicator for the patient outflow (medical service utilization in other regions). For example, if a patient living in Ulsan Metropolitan City uses inpatient or outpatient care at an Ulsan-based medical institution, the case is added to the numerator, increasing the relevance index. In contrast, if that patient uses the facilities from a medical institution located in a different region, the case cannot be added to the numerator, decreasing the relevance index.¹⁹

$RI_{ij} = (\text{Amount of medical service utilization in medical institutions in } j \text{ region by a patient living in } i \text{ region}) / (\text{Total amount of medical service utilization by a patient living in } i \text{ region})$

This study divided the medical service area into 17 regions according to the 17 municipal and provincial regions. Relevance index analysis was performed based on two criteria: first, service utilization type (inpatient and outpatient) and second, unit (number of patients and total out-of-pocket expenses). However, due to the difficulty in defining the diseases in trauma care with the limited data source, the relevance index of the diseases in the trauma care area was not analyzed.

Descriptive analysis was performed to examine the relevance index by year (2016–2020), region, criteria, essential medical service field, and disease. The mean relevance index considering the number of patients or the total out-of-pocket expenses was summarized as the five-year weighted average relevance index. For example, the five-year weighted average relevance index based on the number of patients in a specific disease was calculated using the following formula.

$$\text{Five-year weighted average relevance index} = (2016A \times 2016B) + (2017A \times 2017B) + (2018A \times 2018B) + (2019A \times 2019B) + (2020A \times 2020B) / (2016A + 2017A + 2018A + 2019A + 2020A)$$

A: Number of patients in a given year for a specific disease, B: relevance index in a given year for a specific disease

Data were processed using Microsoft Excel 2016 (Microsoft Corporation, Seattle, WA, USA), and Stata/SE13.1 (StataCorp, College Station, TX, USA) was used for descriptive analysis.

Ethics statement

This study received approval from the Institutional Review Board of the Ulsan University Hospital (2021-05-042). Informed consent was waived by the board.

RESULTS

Relevance index by essential medical service field

Fig. 1 compares the five-year weighted average of relevance index for each essential medical service field based on the number of outpatient and inpatient care cases at the regional level. Among the seven essential medical service fields, the infection area showed a generally high relevance index, with 8 out of the 17 regions resulting in over 90.0%. In contrast, the cancer area showed a generally low relevance index, with 14 regions (not including Seoul, Daegu, and Busan) resulting in a lower than 75.0% relevance index.

Trends in relevance index by the regional and national averages (2016–2020)

Table 1 shows the changes in the relevance index for each essential medical service field for the number of patients and hospitalization across the country (median of the 17 regions) and each of the 17 regions. Throughout the analysis period (2016–2020), no significant changes were observed in regional relevance. At a national level, variations in the relevance index ranged within 2%p between 2016 and 2020, except for the cardiocerebrovascular area. The area with the most significant decrease in relevance index was the maternal and neonatal area (from 79.1% in 2016 to 77.4% in 2020), and the area with the most significant increase was the cardiocerebrovascular area (from 76.0% in 2016 to 79.7% in 2020).

Trends in relevance index by disease

Table 2 presents the changes in the relevance index for 238 diseases during the analysis period (2016–2020). As of 2020, 31 out of the 234 confirmed occurrence of diseases showed a relevance index of 0.0%; the disease with the lowest relevance index in the cancer area was bone and connective tissue cancer (39.0%), followed by ovarian cancer (46.5%) and mouth cancer (49.0%). In the maternal and neonatal areas, congenital anomalies such as neural tube defects (16.7%), cleft lip and cleft palate (18.5%), and congenital heart anomalies (40.5%) showed low relevance index values. In contrast, the relevance index values of ischemic stroke and ischemic heart disease, specific diseases in the cardiocerebrovascular area, were as high as 80.1% and 78.8%, respectively. In the mental health field, apart from addiction-related diseases, bulimia nervosa (0.0%) and autism (57.1%) showed low relevance index values. The relevance index trends by disease for each of the 17 regions are shown in the appendix file (**Supplementary Tables 2-18**).

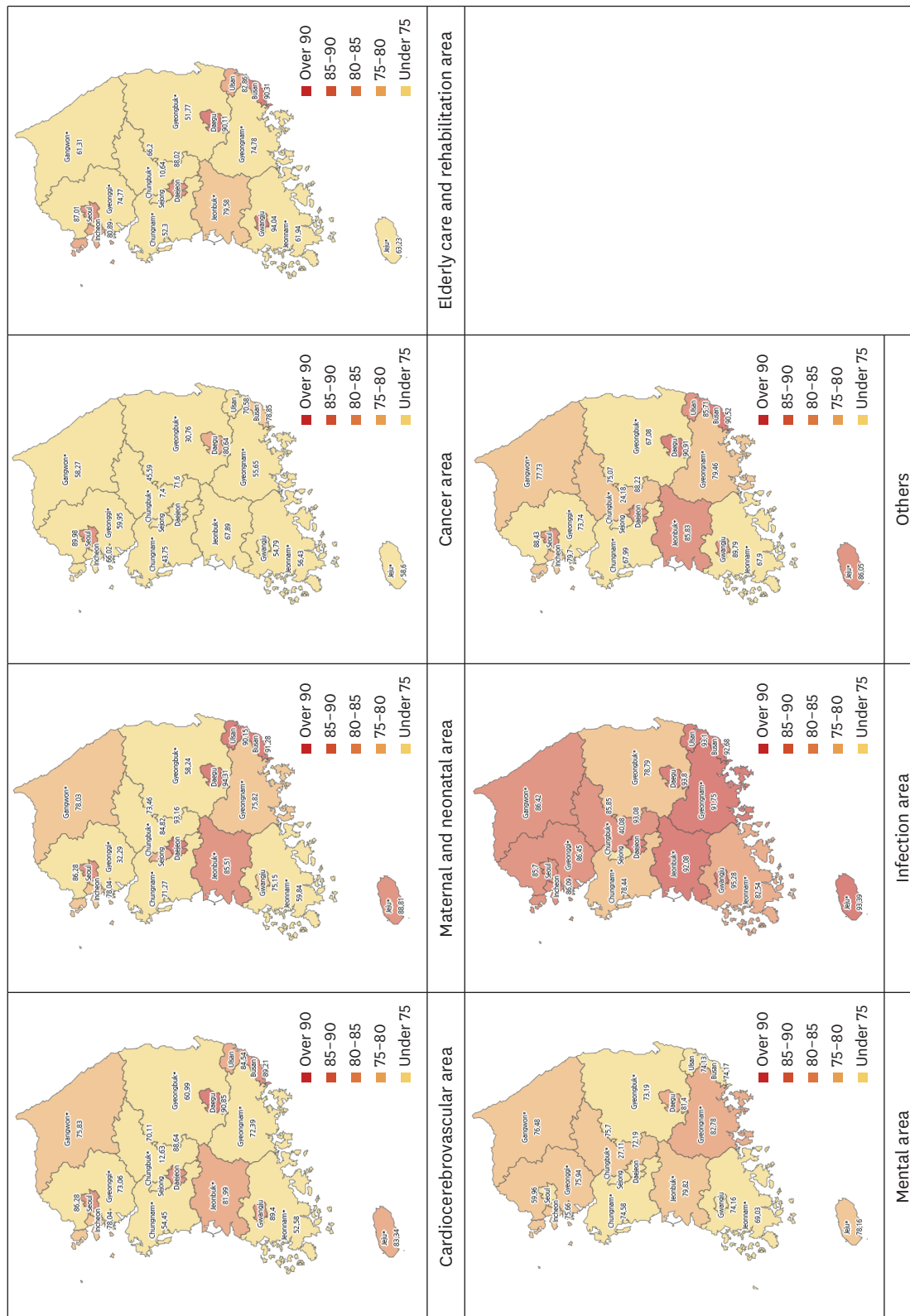


Fig. 1. Weighted average of relevance index by essential medical service fields in 2016–2020 (based on the number of patients: inpatient). Gyeonggi, Gyeonggi-do; Gangwon, Gangwon-do; Chungbuk, Chungcheongbuk-do; Jeonbuk, Jeollabuk-do; Jeonnam, Jeollanam-do; Gyeongbuk, Gyeongsangbuk-do; Gyeongnam, Gyeongsangnam-do; Jeju, Jeju-do

Table 1. Relevance index by each essential medical service field in 17 regions by year (based on the number of patients: inpatient)

Area	Region	2016	2017	2018	2019	2020
Cardiocerebrovascular	Seoul	84.9	86.2	86.2	86.9	87.2
	Busan	89.4	88.9	89.0	89.1	89.7
	Daegu	90.5	90.6	90.6	91.0	91.7
	Incheon	75.4	77.7	78.2	79.0	79.7
	Gwangju	89.3	89.1	89.5	89.3	89.9
	Daejeon	88.6	88.7	88.5	89.1	88.3
	Ulsan	83.7	84.7	83.7	84.5	86.1
	Sejong	8.2	8.3	6.4	4.1	19.5
	Gyeonggi-do	73.7	72.8	72.9	73.0	72.9
	Gangwon-do	76.0	76.1	76.4	74.6	76.1
	Chungcheongbuk-do	69.8	69.6	69.9	70.0	71.3
	Chungcheongnam-do	54.8	55.6	54.6	53.6	53.6
	Jeollabuk-do	82.0	81.6	81.4	82.0	83.1
	Jeollanam-do	53.9	52.7	51.8	51.3	53.1
	Gyeongsangbuk-do	61.0	61.5	61.2	60.3	61.0
	Gyeongsangnam-do	71.3	72.5	72.5	72.5	73.2
	Jeju-do	84.9	84.2	82.0	81.6	83.9
	Total (median)	76.0	77.7	78.2	79.0	79.7
Maternal and neonatal	Seoul	89.0	89.7	89.7	90.4	91.0
	Busan	91.7	91.7	91.3	90.7	90.8
	Daegu	94.5	94.3	94.2	94.4	94.1
	Incheon	76.4	76.6	73.7	73.8	74.8
	Gwangju	93.8	93.0	93.4	92.9	92.5
	Daejeon	89.9	90.1	90.8	89.9	90.2
	Ulsan	84.2	85.1	84.6	84.9	85.5
	Sejong	21.0	21.1	25.3	34.5	43.4
	Gyeonggi-do	78.9	78.3	78.1	77.2	77.4
	Gangwon-do	79.1	78.9	78.2	76.9	76.6
	Chungcheongbuk-do	75.1	74.5	73.5	71.1	72.3
	Chungcheongnam-do	71.2	71.1	71.5	70.7	71.9
	Jeollabuk-do	86.7	86.6	84.8	84.0	84.7
	Jeollanam-do	61.1	60.8	58.7	59.1	58.9
	Gyeongsangbuk-do	61.6	59.4	58.1	55.3	54.2
	Gyeongsangnam-do	76.2	75.9	75.9	75.3	75.6
	Jeju-do	90.1	89.8	87.8	88.1	87.6
	Total (median)	79.1	78.9	78.2	77.2	77.4
Mental health	Seoul	60.0	61.2	60.8	60.0	57.1
	Busan	72.7	73.6	73.4	75.3	76.1
	Daegu	80.7	80.0	81.5	82.6	82.5
	Incheon	72.3	74.8	76.6	77.1	77.6
	Gwangju	73.0	73.7	75.7	74.3	74.1
	Daejeon	73.4	72.3	70.1	72.6	72.4
	Ulsan	71.4	73.3	72.6	78.2	74.9
	Sejong	14.2	10.1	10.1	8.0	12.2
	Gyeonggi-do	76.2	76.0	75.8	76.0	75.8
	Gangwon-do	75.8	77.6	76.6	76.5	75.8
	Chungcheongbuk-do	74.6	75.3	76.8	77.6	73.9
	Chungcheongnam-do	72.2	76.3	75.4	74.0	74.8
	Jeollabuk-do	81.7	78.4	79.3	79.1	80.5
	Jeollanam-do	68.3	69.1	69.2	69.1	69.6
	Gyeongsangbuk-do	72.9	72.5	73.1	73.1	74.6
	Gyeongsangnam-do	81.7	82.8	83.0	83.3	83.1
	Jeju-do	76.7	78.3	77.0	78.1	80.9
	Total (median)	73.0	74.8	75.7	76.0	74.9
Infection	Seoul	86.5	85.8	85.6	85.8	83.8
	Busan	93.2	92.7	92.7	92.8	91.3
	Daegu	93.7	93.5	94.0	94.6	92.6
	Incheon	86.0	86.1	85.8	86.6	86.0

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Table 1. (Continued) Relevance index by each essential medical service field in 17 regions by year (based on the number of patients: inpatient)

Area	Region	2016	2017	2018	2019	2020
	Gwangju	95.1	95.4	95.4	95.5	94.7
	Daejeon	92.7	92.3	93.2	94.1	92.6
	Ulsan	93.1	93.2	93.2	93.3	92.2
	Sejong	9.8	16.8	34.7	41.7	55.5
	Gyeonggi-do	86.6	86.1	86.5	87.0	85.6
	Gangwon-do	86.7	86.7	86.6	86.1	85.5
	Chungcheongbuk-do	87.2	85.6	85.6	85.4	84.6
	Chungcheongnam-do	79.0	78.4	78.8	78.2	77.3
	Jeollabuk-do	91.9	91.7	92.2	92.4	92.4
	Jeollanam-do	83.1	81.7	81.5	83.4	83.3
	Gyeongsangbuk-do	79.8	78.7	79.0	78.1	77.7
	Gyeongsangnam-do	91.5	91.4	91.8	92.2	91.9
	Jeju-do	94.0	93.3	92.9	93.4	93.1
	Total (median)	87.2	86.7	86.6	87.0	86.0
Cancer	Seoul	89.7	89.8	89.8	90.3	90.3
	Busan	79.3	79.1	78.5	78.1	79.4
	Daegu	81.4	80.6	79.8	80.7	80.8
	Incheon	65.7	67.2	66.4	65.4	65.4
	Gwangju	55.4	54.1	54.3	54.8	55.3
	Daejeon	73.0	72.0	71.4	70.9	70.8
	Ulsan	71.3	70.1	70.6	69.5	71.5
	Sejong	3.4	3.2	3.0	3.7	11.0
	Gyeonggi-do	60.6	60.2	59.8	59.5	59.8
	Gangwon-do	59.3	59.1	57.2	57.2	58.6
	Chungcheongbuk-do	45.7	46.2	45.6	45.1	45.3
	Chungcheongnam-do	43.3	43.6	44.2	43.6	43.9
	Jeollabuk-do	67.7	68.2	67.0	67.5	69.0
	Jeollanam-do	56.0	56.4	56.0	56.3	57.4
	Gyeongsangbuk-do	31.3	31.5	31.0	30.2	29.9
	Gyeongsangnam-do	55.0	56.0	55.5	55.2	56.6
Older adults' care and rehabilitation	Jeju-do	59.9	60.3	57.5	56.7	58.8
	Total (median)	59.9	60.2	57.5	57.2	58.8
	Seoul	86.8	86.8	86.9	87.4	87.2
	Busan	90.9	89.9	89.7	89.9	91.1
	Daegu	90.3	89.6	89.9	90.1	90.6
	Incheon	80.8	81.3	81.4	80.9	79.8
	Gwangju	94.0	94.4	94.2	93.7	93.9
	Daejeon	88.4	87.6	87.6	88.2	88.3
	Ulsan	82.7	82.7	83.0	82.9	83.1
	Sejong	6.0	6.6	6.5	9.5	15.5
	Gyeonggi-do	75.1	74.3	74.7	74.7	75.0
	Gangwon-do	61.7	61.9	61.3	60.7	61.2
	Chungcheongbuk-do	66.5	66.2	66.3	66.0	66.1
	Chungcheongnam-do	50.3	52.1	52.2	52.4	54.5
	Jeollabuk-do	80.3	80.2	79.2	78.6	79.7
	Jeollanam-do	62.9	62.3	61.1	61.2	62.4
Others	Gyeongsangbuk-do	52.2	52.1	52.2	51.2	51.2
	Gyeongsangnam-do	73.6	74.7	74.6	75.2	75.8
	Jeju-do	64.8	61.8	61.8	62.7	65.2
	Total (median)	75.1	74.7	74.7	75.2	75.8
	Seoul	87.7	88.2	88.4	88.8	89.0
	Busan	90.7	90.4	90.3	90.5	90.8
	Daegu	90.6	90.6	90.9	91.3	91.2
	Incheon	80.3	80.6	79.8	79.4	78.5
	Gwangju	89.5	89.8	89.9	90.0	89.8
	Daejeon	88.6	88.4	88.2	88.3	87.5
	Ulsan	85.8	85.7	85.5	85.7	85.8
	Sejong	16.2	19.0	18.1	19.3	34.4

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Table 1. (Continued) Relevance index by each essential medical service field in 17 regions by year (based on the number of patients: inpatient)

Area	Region	2016	2017	2018	2019	2020
	Gyeonggi-do	76.1	75.3	74.0	72.7	70.6
	Gangwon-do	78.1	78.6	77.9	77.0	77.2
	Chungcheongbuk-do	75.8	75.5	75.0	74.7	74.4
	Chungcheongnam-do	68.9	68.4	68.0	67.7	66.8
	Jeollabuk-do	85.9	86.4	85.8	85.5	85.6
	Jeollanam-do	69.3	68.8	67.4	66.8	67.3
	Gyeongsangbuk-do	68.5	68.1	67.1	65.8	65.8
	Gyeongsangnam-do	80.1	79.9	79.5	79.1	78.6
	Jeju-do	86.9	86.4	85.5	85.2	86.3
	Total (median)	80.3	80.6	79.8	79.4	78.6

Units: %.

Table 2. Trends in relevance index by disease related to essential medical service (based on the number of inpatients: median of 17 regions)

No.	Diseases	2016	2017	2018	2019	2020
1	Tuberculosis	77.6	78.8	77.2	78.3	82.0
2	HIV disease resulting in mycobacterial infection	0.0	0.0	0.0	0.0	0.0
3	HIV disease resulting in other specified or unspecified diseases	55.6	56.6	58.6	68.4	71.9
4	Cholera	83.3	0.0	0.0	0.0	0.0
5	Other salmonella infections	90.5	89.8	91.8	87.3	89.8
6	Shigellosis	100.0	93.3	94.1	100.0	100.0
7	Enteropathogenic E coli infection	50.0	71.4	0.0	0.0	0.0
8	Enterotoxigenic E coli infection	0.0	0.0	50.0	87.5	25.0
9	Campylobacter enteritis	91.3	91.1	90.3	90.7	91.9
10	Amoebiasis	80.9	76.1	75.0	73.2	68.5
11	Cryptosporidiosis	0.0	0.0	0.0	100.0	0.0
12	Rotaviral enteritis	89.6	92.6	93.9	90.3	90.9
13	Intestinal infection	91.8	85.5	85.3	85.4	83.7
14	Other diarrheal diseases	88.4	88.9	87.9	89.0	89.2
15	Typhoid and paratyphoid fevers	88.9	88.9	72.7	100.0	100.0
16	Influenza	92.3	89.8	89.5	91.2	90.0
17	Pneumococcal pneumonia	83.3	82.8	83.3	83.9	80.7
18	H influenza type B pneumonia	83.3	80.0	88.7	90.0	88.0
19	Respiratory syncytial virus pneumonia	89.1	91.4	90.7	85.7	86.2
20	Other lower respiratory infections	88.4	87.6	87.0	86.9	85.8
21	Upper respiratory infections	88.3	88.7	89.4	90.0	89.3
22	Otitis media	80.0	81.6	81.0	79.5	76.2
23	Pneumococcal meningitis	50.0	0.0	0.0	0.0	0.0
24	H influenza type B meningitis	0.0	0.0	0.0	0.0	0.0
25	Meningococcal infection	0.0	0.0	0.0	0.0	0.0
26	Other meningitis	91.5	87.3	86.2	86.5	84.1
27	Encephalitis	68.7	65.0	65.6	65.2	60.6
28	Diphtheria	0.0	0.0	0.0	0.0	0.0
29	Whooping cough	100.0	86.7	95.7	96.9	90.0
30	Tetanus	62.5	63.3	100.0	80.4	90.0
31	Measles	85.7	75.0	83.3	86.2	0.0
32	Varicella	87.7	89.4	87.5	87.5	88.5
33	Malaria	50.0	50.0	82.9	50.0	85.1
34	Chagas disease	50.0	0.0	50.0	0.0	0.0
35	Leishmaniasis	0.0	0.0	0.0	0.0	0.0
36	African trypanosomiasis	50.0	50.0	0.0	0.0	0.0
37	Schistosomiasis	0.0	0.0	0.0	0.0	0.0
38	Cysticercosis	66.1	60.8	58.3	47.2	55.0
39	Echinococcosis	0.0	0.0	0.0	50.0	0.0
40	Lymphatic filariasis	-	-	-	-	-
41	Onchocerciasis	-	-	-	-	-
42	Trachoma	0.0	50.0	0.0	50.0	0.0

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Table 2. (Continued) Trends in relevance index by disease related to essential medical service (based on the number of inpatients: median of 17 regions)

No.	Diseases	2016	2017	2018	2019	2020
43	Dengue	-	-	-	-	-
44	Yellow fever	0.0	100.0	0.0	0.0	0.0
45	Rabies	0.0	0.0	100.0	0.0	0.0
46	Ascariasis	0.0	100.0	0.0	0.0	0.0
47	Trichuriasis	100.0	0.0	0.0	0.0	0.0
48	Hookworm disease	0.0	100.0	0.0	50.0	0.0
49	Food-borne trematodiasis	75.0	77.8	80.0	69.2	66.7
50	Tsutsugamushi fever	86.2	78.4	84.2	83.6	84.6
51	Typhus fever	85.6	87.9	66.7	78.3	83.3
52	Hantaan virus disease	90.0	86.5	85.7	75.3	94.1
53	Other neglected tropical diseases	66.3	70.0	69.2	75.8	73.3
54	Intestinal helminth	100.0	100.0	90.9	85.7	71.4
55	Maternal hemorrhage	83.2	83.4	80.7	79.8	81.6
56	Maternal sepsis	89.5	66.7	75.0	75.0	83.3
57	Hypertensive disorders of pregnancy	77.8	79.6	75.5	79.7	76.8
58	Obstructed labor	81.4	84.7	84.3	86.8	88.0
59	Abortion	83.8	80.1	81.1	78.0	83.5
60	Other maternal disorders	83.1	82.8	82.7	82.1	82.5
61	Preterm birth complications	71.0	75.9	73.5	71.8	71.4
62	Neonatal encephalopathy (birth asphyxia and birth trauma)	75.0	71.4	74.4	61.5	66.7
63	Sepsis and other infectious disorders of the newborn baby	79.2	84.8	78.2	77.8	78.4
64	Other neonatal disorders	78.5	76.6	78.4	80.3	75.2
65	Protein-energy malnutrition	56.7	79.0	86.9	83.3	80.0
66	Iodine deficiency	0.0	0.0	0.0	0.0	0.0
67	Vitamin A deficiency	50.0	66.7	50.0	85.7	71.4
68	Iron-deficiency anemia	84.3	83.7	84.7	83.7	84.5
69	Other nutritional deficiencies	77.8	77.4	76.6	81.7	80.9
70	Syphilis	78.1	76.7	82.2	76.7	87.5
71	Sexually transmitted chlamydial diseases	85.0	66.7	88.9	78.6	75.0
72	Gonococcal infection	75.0	50.0	69.4	75.0	66.7
73	Trichomoniasis	41.7	46.4	83.3	0.0	0.0
74	Other sexually transmitted diseases	79.7	78.9	78.7	81.3	79.5
75	Herpes genitalia	83.3	100.0	90.9	85.7	85.7
76	Acute hepatitis A	83.5	84.4	82.0	83.8	83.3
77	Acute hepatitis B	77.3	80.0	83.3	81.3	90.9
78	Acute hepatitis C	83.3	72.7	75.0	85.7	87.5
79	Acute hepatitis E	0.0	40.0	30.0	93.3	25.0
80	Leprosy	0.0	42.4	0.0	0.0	0.0
81	Legionnaires'disease	0.0	0.0	0.0	50.0	100.0
82	Leptospirosis	90.0	84.5	63.3	68.0	72.2
83	Rubella	0.0	50.0	0.0	0.0	0.0
84	Mumps	93.0	93.3	88.6	91.9	96.3
85	Other infectious diseases	85.2	83.2	84.6	85.0	81.5
86	Esophageal cancer	53.4	55.3	54.7	53.0	53.2
87	Stomach cancer	57.2	59.5	58.9	60.3	60.9
88	Liver cancer	55.5	54.8	55.8	55.1	55.0
89	Larynx cancer	61.6	60.7	61.0	59.6	62.7
90	Trachea, bronchus and lung cancers	61.8	61.7	60.2	59.7	60.6
91	Breast cancer	51.2	53.6	54.5	53.4	54.3
92	Cervical cancer	59.9	57.6	55.0	55.1	54.5
93	Uterine cancer	49.3	51.7	56.3	50.0	55.6
94	Prostate cancer	58.6	59.8	58.6	58.3	59.3
95	Colon and rectum cancers	61.3	61.0	60.3	61.0	62.5
96	Mouth cancer	48.8	48.8	48.3	48.0	49.0
97	Nasopharynx cancer	57.1	53.9	57.4	51.3	51.1
98	Cancer of other part of pharynx and oropharynx	58.1	57.5	50.9	55.1	58.3
99	Gallbladder and biliary tract cancer	60.8	59.8	58.8	59.3	61.7
100	Pancreatic cancer	57.1	53.8	55.6	55.1	53.6

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Table 2. (Continued) Trends in relevance index by disease related to essential medical service (based on the number of inpatients: median of 17 regions)

No.	Diseases	2016	2017	2018	2019	2020
101	Malignant melanoma of skin	46.2	51.7	51.0	52.1	52.5
102	Non-melanoma skin cancer	64.0	69.1	68.5	64.2	66.1
103	Ovarian cancer	46.7	45.6	46.9	47.4	46.5
104	Testicular cancer	52.0	54.6	56.3	44.4	55.6
105	Kidney cancer	51.1	53.3	51.4	51.3	53.8
106	Other urinary organ cancers	55.4	50.5	55.7	56.1	57.3
107	Bladder cancer	58.1	59.8	57.3	57.1	57.6
108	Brain and nervous system cancers	59.5	56.9	56.1	54.4	55.1
109	Thyroid cancer	56.6	52.0	48.7	48.5	49.4
110	Hodgkin's disease	54.3	55.2	52.9	52.9	54.8
111	Non-Hodgkin's lymphoma	52.3	50.9	50.6	50.6	51.6
112	Multiple myeloma	50.2	55.6	59.6	56.5	58.7
113	Leukemia	50.2	54.4	49.9	53.2	53.5
114	Bone and connective tissue cancer	41.0	41.8	37.9	40.6	39.0
115	Benign neoplasm of brain and other parts of central nervous system	54.7	56.0	55.7	51.1	51.4
116	Other neoplasms and unspecified cancer	70.7	71.8	69.3	68.6	71.2
117	Rheumatic heart disease	57.6	53.2	55.0	57.3	56.4
118	Ischemic heart disease	76.4	78.2	78.5	78.4	78.8
119	Ischemic stroke	77.3	77.7	78.9	79.0	80.1
120	Hemorrhagic and other non-ischemic stroke	76.7	79.1	79.9	80.3	81.0
121	Hypertensive heart disease	86.2	84.7	85.1	88.8	83.9
122	Cardiomyopathy and myocarditis	70.2	69.6	70.2	69.1	69.9
123	Atrial fibrillation and flutter	72.9	73.5	75.3	70.8	72.9
124	Aortic aneurysm	63.2	63.5	62.9	61.6	65.0
125	Peripheral vascular disease	76.4	75.2	73.3	73.2	77.5
126	Endocarditis	57.8	65.5	64.7	59.8	64.1
127	Hemorrhoid	-	-	-	-	-
128	Varicose veins of lower extremities	77.1	80.9	79.8	82.3	82.1
129	Other cardiovascular and circulatory diseases	76.4	76.8	77.6	77.7	78.8
130	Chronic obstructive pulmonary disease	85.7	86.8	85.8	86.0	86.2
131	Pneumoconiosis	76.3	66.7	66.7	76.1	76.5
132	Asthma	88.9	87.9	87.5	86.8	86.3
133	Interstitial lung disease and pulmonary sarcoidosis	72.5	69.0	72.3	69.3	71.4
134	Other chronic respiratory diseases	79.7	79.0	79.3	77.9	73.0
135	Cirrhosis of the liver	83.3	84.6	83.0	84.1	84.7
136	Peptic ulcer disease	86.7	85.9	85.5	85.7	87.3
137	Gastritis and duodenitis	82.5	84.5	85.6	85.5	87.4
138	Appendicitis	86.5	85.7	87.3	85.7	87.6
139	Paralytic ileus and intestinal obstruction without hernia	85.6	85.3	84.9	83.0	86.1
140	Inguinal or femoral hernia	71.9	74.5	72.9	70.1	71.2
141	Crohn's disease	63.3	62.7	64.3	59.2	62.6
142	Ulcerative colitis	75.0	68.2	68.8	70.2	72.4
143	Other noninfective inflammatory bowel disease	88.0	86.3	85.5	86.1	85.9
144	Vascular disorders of intestine	79.3	82.5	82.0	81.7	84.5
145	Gall bladder and bile duct disease	78.1	78.3	78.3	78.8	81.1
146	Pancreatitis	82.3	81.7	81.7	82.0	82.7
147	Gastroesophageal reflux disease	84.1	84.7	87.3	86.5	88.0
148	Other digestive diseases	80.4	81.2	81.3	81.2	82.2
149	Alzheimer's disease and other dementias	77.9	78.7	79.2	79.8	80.6
150	Parkinson's disease	75.6	76.3	76.6	76.9	78.2
151	Epilepsy	74.4	75.5	73.7	71.6	73.4
152	Multiple sclerosis	61.7	56.7	64.8	57.6	57.6
153	Migraine	82.9	83.9	85.3	83.1	86.0
154	Tension-type headache	85.7	84.7	86.2	86.2	87.0
155	Other neurological disorders	74.6	73.3	71.7	72.2	74.5
156	Schizophrenia	74.8	74.1	74.6	75.3	74.4
157	Alcohol use disorders	73.6	75.9	74.9	77.1	74.9
158	Opioid use disorders	62.0	100.0	61.7	71.9	64.9

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Table 2. (Continued) Trends in relevance index by disease related to essential medical service (based on the number of inpatients: median of 17 regions)

No.	Diseases	2016	2017	2018	2019	2020
159	Cocaine use disorders	100.0	0.0	0.0	0.0	0.0
160	Amphetamine use disorders	50.0	70.0	0.0	58.8	60.0
161	Cannabis use disorders	0.0	0.0	0.0	75.0	0.0
162	Other drug use disorders	85.2	85.4	85.2	87.4	82.2
163	Major depressive disorders	78.4	77.9	77.6	78.7	78.5
164	Dysthymia	78.6	75.0	70.7	69.2	75.6
165	Bipolar affective disorder	72.3	73.5	73.3	73.9	72.6
166	Panic disorder	78.1	80.0	81.9	78.3	77.8
167	Obsessive-compulsive disorder	66.7	71.4	71.4	80.0	73.9
168	Post-traumatic stress disorder	76.0	76.9	80.0	66.7	75.0
169	Other anxiety disorder	82.3	83.2	82.6	81.8	80.8
170	Anorexia nervosa	69.2	71.4	75.0	66.7	88.1
171	Bulimia nervosa	50.0	20.0	33.3	58.3	0.0
172	Other eating disorders	82.4	85.7	80.0	82.8	80.0
173	Autism	62.5	66.7	63.6	73.3	57.1
174	Asperger's syndrome	75.6	50.0	74.2	63.3	81.3
175	Attention-deficit hyperactivity disorder	72.7	64.3	68.2	78.1	74.4
176	Conduct disorder	66.7	69.2	69.2	81.8	81.0
177	Idiopathic intellectual disability	66.0	63.7	67.0	66.8	66.1
178	Borderline personality disorder	75.9	70.6	83.3	75.0	78.6
179	Other mental health and behavioral disorders	74.4	75.0	73.0	77.0	73.8
180	Diabetes mellitus	82.7	83.1	82.2	83.2	83.6
181	Acute glomerulonephritis	86.2	84.1	76.0	79.4	80.9
182	Chronic kidney disease due to diabetes mellitus	82.7	84.9	83.9	83.4	83.3
183	Chronic kidney disease due to hypertension	79.1	79.3	75.0	79.4	76.0
184	Chronic kidney disease unspecified	65.4	69.1	69.6	74.0	70.1
185	Tubulointerstitial nephritis, pyelonephritis, and urinary tract infections	86.8	86.9	87.2	87.7	88.7
186	Urolithiasis	86.1	85.3	85.4	85.4	86.7
187	Benign prostatic hyperplasia	71.5	73.3	72.7	72.0	76.9
188	Male infertility	41.7	45.5	41.1	35.0	38.1
189	Other urinary diseases	74.6	74.6	72.5	75.1	74.1
190	Urinary incontinence	78.3	78.0	77.3	78.9	78.4
191	Uterine fibroids	68.2	70.4	71.3	72.3	72.6
192	Polycystic ovarian syndrome	73.2	82.3	100.0	71.4	81.7
193	Female infertility	79.0	67.7	60.0	57.1	71.4
194	Endometriosis	69.0	70.7	67.4	65.8	65.0
195	Genital prolapse	73.1	73.9	71.7	75.2	71.6
196	Premenstrual syndrome	76.8	33.3	83.3	62.5	37.5
197	Other gynecological diseases	74.4	72.7	72.3	73.6	74.1
198	Thalassemias	0.0	100.0	0.0	66.7	0.0
199	Sickle cell disorders	0.0	100.0	0.0	0.0	0.0
200	G6PD deficiency	0.0	0.0	0.0	0.0	0.0
201	Other hemoglobinopathies and hemolytic anemias	70.2	70.6	71.7	71.1	74.3
202	Other endocrine, nutritional, blood, and immune disorders	78.4	76.9	76.8	74.2	73.4
203	Rheumatoid arthritis	69.1	78.1	67.7	78.6	73.1
204	Osteoarthritis	70.0	70.2	70.9	71.0	70.4
205	Low back pain	74.9	76.8	77.0	77.2	77.6
206	Neck pain	78.9	79.5	80.4	81.9	80.9
207	Gout	86.2	86.2	87.2	87.4	87.0
208	Systemic lupus erythematosus (SLE)	60.4	59.0	58.9	61.8	65.7
209	Other musculoskeletal disorders	76.2	74.9	75.1	75.1	75.5
210	Neural tube defects	22.2	20.0	22.2	16.7	16.7
211	Congenital heart anomalies	38.7	40.9	41.2	39.7	40.5
212	Cleft lip and cleft palate	29.6	25.4	18.2	22.2	18.5
213	Down's syndrome	66.7	72.2	66.7	60.0	83.3
214	Other chromosomal abnormalities	50.0	50.0	50.0	44.4	50.0
215	Other congenital anomalies	53.5	56.2	52.8	53.6	52.5
216	Eczema	80.5	81.7	81.3	80.0	78.6

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Table 2. (Continued) Trends in relevance index by disease related to essential medical service (based on the number of inpatients: median of 17 regions)

No.	Diseases	2016	2017	2018	2019	2020
217	Psoriasis	78.6	75.0	76.5	82.8	81.5
218	Cellulitis	87.3	87.7	88.5	88.1	87.6
219	Abscess, impetigo, and other bacterial skin diseases	82.4	83.3	85.3	85.7	86.3
220	Scabies	75.0	76.0	77.8	80.0	73.1
221	Fungal skin diseases	82.1	81.0	81.0	80.5	77.9
222	Viral skin diseases	88.8	88.0	90.4	89.4	88.6
223	Acne vulgaris	50.0	100.0	66.7	0.0	50.0
224	Alopecia areata	62.0	51.5	50.0	58.3	50.0
225	Pruritus	87.5	84.4	81.8	84.9	83.1
226	Urticaria	86.6	86.0	86.7	86.0	84.9
227	Decubitus ulcer	81.7	82.1	82.9	81.5	81.8
228	Other skin and subcutaneous diseases	81.5	80.4	82.5	78.8	80.2
229	Glaucoma	64.9	67.2	65.4	54.8	58.1
230	Cataracts	82.8	80.9	79.0	78.1	76.7
231	Macular degeneration	45.6	59.4	51.6	52.5	55.1
232	Refraction and accommodation disorders	44.0	50.8	53.1	48.3	54.8
233	Other hearing loss	75.8	77.2	74.8	71.0	73.5
234	Other vision loss	56.7	56.5	55.1	62.5	64.6
235	Other sense organ diseases	80.4	83.2	83.7	84.8	83.4
236	Dental caries	76.1	75.7	73.1	69.1	70.8
237	Periodontal disease	76.3	78.7	79.7	77.6	77.9
238	Sudden infant death syndrome	0.0	0.0	100.0	0.0	0.0

Units: %.

Comparison of relevance index by criterion

Comparing the relevance index between inpatient and outpatient care revealed that in all 17 regions, inpatient care had a lower relevance index than outpatient care (Fig. 2). The region with the most substantial difference was Sejong (inpatient: 22.4%, outpatient: 63.9%, difference: 41.5%p), followed by Chungcheongnam-do (inpatient: 64.2%, outpatient: 82.0%, difference: 17.8%p) and Gyeongsangbuk-do (inpatient: 62.6%, outpatient: 80.3%, difference: 17.7%p). Furthermore, the relevance index based on total out-of-pocket expenses was lower than that based on the number of patients in all 17 regions (Fig. 3). The region with the least significant difference was Seoul (87.1% by the number of patients, 83.7% by out-of-pocket expenses, difference of 3.4%p), and the region with the most significant difference was Gwangju (89.0% by the number of patients, 76.8% by out-of-pocket expenses, difference of 12.2%p).

DISCUSSION

This study analyzed trends of relevance index over time (2016–2020) for each disease in each essential medical service field. The analysis results can be summarized as follows: among the essential medical service fields, the infection and cancer areas showed the highest and lowest relevance index values, respectively. Among the individual diseases, those characterized by a low relevance index were bone and connective tissue cancer (39.0%), ovarian cancer (46.5%), neural tube defects (16.7%), cleft lip and cleft palate (18.5%), and autism (57.1%). Regarding annual trends, the relevance index showed no significant improvement, overall. Moreover, in all 17 regions, inpatient care had a lower relevance index than outpatient care. Additionally, the relevance index based on total out-of-pocket expenses was lower than that based on the number of patients in all 17 regions.

Residents of any region have the right to receive high-quality essential medical services, and the government must ensure such a system. This study's results can enable the identification

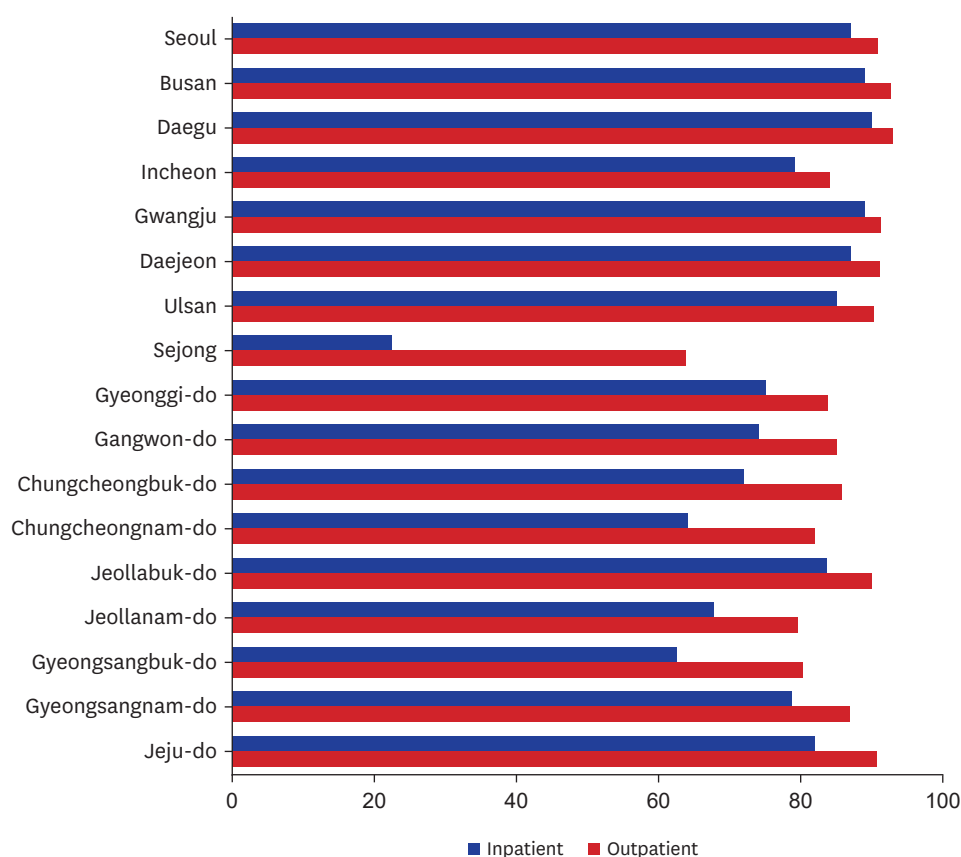


Fig. 2. Five-year (2016–2020) weighted average of inpatient and outpatient relevance index based on the number of patients in 17 regions.

of the insufficient essential medical service fields of each region and used as source data for placing a delivery system for such fields. To date, analysis of medical service regions, such as relevance index analysis, has tended to approach from the perspective of hospital divisions,^{10-12,20} which does not provide a detailed picture of the situation in the current ever-evolving medical specialty and subspecialty system anymore. Therefore, a shift to disease-based medical service region analysis, like the one adopted in this study, is necessary to provide more detailed improvement strategies. In particular, in this study, the disease classification system of the KNBD study,^{16,17} which presented the ranking of disease burden as an indicator of DALYs, was used. By considering the RI ranking in this study together with the DALYs ranking by disease in the previous study,²¹ it will be possible to confirm the priority of establishing a medical service supply system for each disease in the region.

From the relevance index by the essential medical service field, the infection and cancer areas showed the highest and lowest relevance index values, respectively. This highlights the urgency of constructing strategies to improve the cancer area relevance index. Despite doubts raised about the adequacy of including cancer in the essential medical service fields, because cancer is not an emergency disease, cancer certainly falls under the category of the essential medical area when defined as a medical service that significantly affects life and health-related quality of life.¹⁴ Specifically, cancer care is not simply a matter of surgery or procedure but primarily requires continuous treatment such as chemotherapy, which is reported to be crucial for the cancer survival rate.²² Therefore, it is necessary to establish a system capable

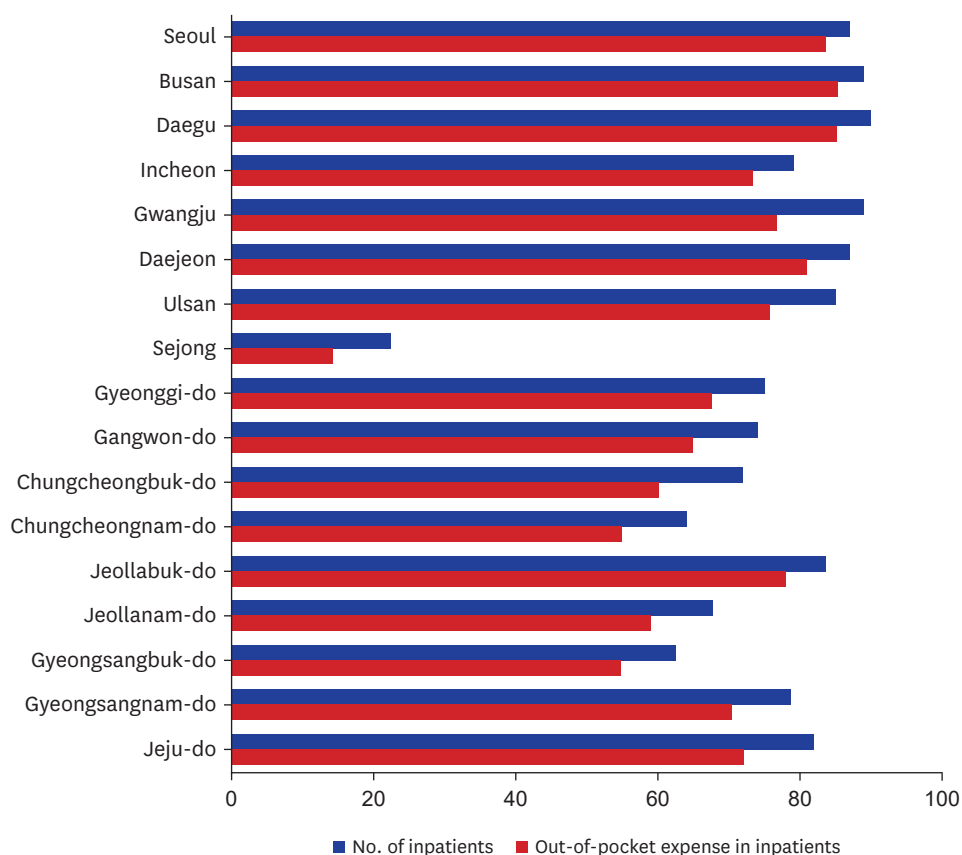


Fig. 3. Five-year (2016–2020) weighted average of the number of inpatients and out-of-pocket expense in inpatients relevance index based on the number of patients (inpatient) in 17 regions.

of providing high-quality cancer care within the community. Immediately improving the relevance index related to cancer surgery may be complex; hence, constructing and operating an integrated community care system for postoperative cancer patients can be considered an alternative. The capacity to provide high-quality cancer care for each municipal and provincial region must also be reinforced, and support measures at the national level must be established for the long term.

While the cancer area had the lowest relevance index in most regions, there were exceptions to this trend, indicating the need for a strategy to support weak areas in the affected regions. For example, Seoul and Busan had the lowest relevance index in the mental health area and Jeollanam-do in the cardiocerebrovascular area. This makes it possible to infer that vulnerable essential medical service fields may exist even in metropolitan cities, such as Seoul or Busan. Additionally, even among the region where the cancer area had the lowest relevance index, there were interregional variances in the cancer type. For example, leukemia showed the lowest relevance index in Gwangju, testicular cancer in Daejeon, and bone and connective tissue cancer in Ulsan. Given these inevitable variations in the regional relevance index status among the diseases of each essential medical service field by region, coping measures customized to regional characteristics of the relevance index must be established. A disease-specific approach to improving relevance index will help identify the necessary medical staffs and equipment, and ultimately contribute to improving mortality rates in the region.²³

It is worth noting that there is no significant change in relevance index when looking at the annual change trend of relevance index. In Korea, various center designation projects, such as Regional Cancer Center,²⁴ have been carried out to improve the level of essential medical care system in the region, but it seems difficult to grasp the effect when considering the trends of the relevance index from this study. The insufficient level of improvement in relevance index supports the need for effective strategies to further strengthen the level of the essential medical care system in the region. Rather, the relevance index even decreased in the maternal and neonatal areas (from 79.1% in 2016 to 77.4% in 2020). It is necessary to fundamentally reexamine the delivery system improvement projects carried out in the maternal and neonatal areas, such as the Supporting Program for Obstetric Care Underserved Areas.²⁵ On the other hand, the relevance index slightly increased in the cardiocerebrovascular area (from 76.0% in 2016 to 79.7% in 2020), and it is necessary to examine whether the expansion of the Regional CardioCerebroVascular Center's designation contributed to this phenomenon.^{26,27}

Notably, the relevance index based on total out-of-pocket expenses are lower than the number of patients. This phenomenon was noticeable in all essential medical service fields in metropolitan areas, such as Busan, Daegu, and Ulsan, as well as in generally vulnerable medical regions, such as Gangwon-do and Chungcheongnam-do. This suggests that patients spend more out-of-pocket expenses when receiving essential medical services in other regions. However, the patients may receive essential medical services in other regions due to the high severity of the disease, and this severity may worsen during transit to another region. This aspect must be considered by future research by examining the treatment results of patients who have received essential medical services in regions other than their regions. If no significant difference is found in patient outcomes between the treatments in the residential and other regions, encouraging patients to receive treatment in their residential regions can help increase the health insurance cost-effectiveness. In other words, this indicates that expanding medical institutions with the capacity to provide high quality essential medical care in the region can have advantages not only in terms of equity but also in terms of financial efficiency.

This study examined only out-of-pocket expenses of health insurance, but receiving treatment in a different region involves additional costs for transport and the accompanying caregiver (if any) and additional time, doubling the total costs.²⁸ If local residents travel to other regions to receive essential medical services because there is no reliable healthcare delivery system in the residential region, such additional costs are incurred by them alone. Therefore, the total medical expenses spent in other regions can help estimate the costs that can be saved by building a local healthcare delivery system that ensures essential medical services.

This study has some limitations, and proposals are presented to address these limitations. First, emergency cases could not be identified in this study. For the cardiocerebrovascular area, for example, it is of utmost importance whether emergency care was provided within the crucial hour. In this study, however, relevance index analysis considered emergency and non-emergency cases combined. It does not mean that an essential health care system should be established only in emergency situations, but the inability to provide adequate medical care in the region even in emergency situations would be a bigger problem. In future research, relevance index analysis must examine whether or not the cases reviewed are emergency cases in each essential medical service field.

Second, the relevance index analysis of the trauma care area, an important essential medical service field, could not be performed. In various other injuries, such as severe trauma, it is crucial to have an emergency care delivery system capable of providing treatment within the crucial hour, as in cardiocerebrovascular disease, and build a local management system. Since the data from the National Health Insurance Service do not clearly indicate the mechanism of injury, it was difficult to analyze the relevance index in the trauma area fitting the disease classification system criteria of the KNBD study. In future research, it is necessary to reinforce the relevance index analysis of the trauma care area by using data that can confirm injury cases, such as the discharge injury in-depth survey data.

Third, the essential medical services quality provided could not be accurately assessed; the relevance index analysis only concerned whether inpatient or outpatient care was provided. In addition, it was difficult to ascertain whether the medical services provided met the expectations of patients and caregivers. In future research, this must be assessed for treatment outcomes and patient or caregiver satisfaction and experience. For example, it would be a noteworthy undertaking to examine whether there is a significant difference in the five-year survival and patient experience between cancer patients treated in their own and other regions.

Fourth, relevance index analysis must also include uncovered medical expenses. In this study, relevance index analysis was performed only on out-of-pocket expenses, and whether the inclusion of uncovered expenses will negatively affect the relevance index must be examined. If it worsens the relevance index relative to the total medical expenses compared with this study's estimated value, the need for a medical institution providing high-quality essential medical services in the concerned region becomes more compelling.

Finally, adopting this study's research methodology, the scope of research can be extended to analyzing the relevance index at the district and county level or in subregional units, contributing to creating subregional public health service plans or regional healthcare delivery plans. For cardiocerebrovascular and maternal and neonatal areas, specifically, having a healthcare delivery system is more advantageous at the subregional level (districts and counties) over the regional level (municipalities and provinces). Analysis of the subregional relevance index at the subregional level can help detect medically disadvantaged areas within a region.

As a strategy to reduce regional health inequalities, establishing an independent regional healthcare delivery system to provide essential medical services is drawing increasing attention. This undertaking requires extended time and continuous monitoring of the system level. The relevance index of each disease in each essential medical service field analyzed in this study can provide a good indicator to monitor the level of regionally independent essential medical services. The study's methodology and results can form the basis for building a system capable of relevance index monitoring in a comprehensive way at the national level.

SUPPLEMENTARY MATERIALS

Supplementary Table 1

List of 260 diseases

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Supplementary Table 2

Trends in relevance index in Seoul by disease related to essential medical service (based on the number of inpatients)

[Click here to view](#)

Supplementary Table 3

Trends in relevance index in Busan by disease related to essential medical service (based on the number of inpatients)

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Supplementary Table 4

Trends in relevance index in Daegu by disease related to essential medical service (based on the number of inpatients)

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Supplementary Table 5

Trends in relevance index in Incheon by disease related to essential medical service (based on the number of inpatients)

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Supplementary Table 6

Trends in relevance index in Gwangju by disease related to essential medical service (based on the number of inpatients)

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Supplementary Table 7

Trends in relevance index in Daejeon by disease related to essential medical service (based on the number of inpatients)

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Supplementary Table 8

Trends in relevance index in Ulsan by disease related to essential medical service (based on the number of inpatients)

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Supplementary Table 9

Trends in relevance index in Sejong by disease related to essential medical service (based on the number of inpatients)

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Supplementary Table 10

Trends in relevance index in Gyeonggi-do by disease related to essential medical service (based on the number of inpatients)

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Supplementary Table 11

Trends in relevance index in Gangwon-do by disease related to essential medical service (Based on the number of inpatients)

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Supplementary Table 12

Trends in relevance index in Chungcheongbuk-do by disease related to essential medical service (based on the number of inpatients)

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Supplementary Table 13

Trends in relevance index in Chungcheongnam-do by disease related to essential medical service (based on the number of inpatients)

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Supplementary Table 14

Trends in relevance index in Jeollabuk-do by disease related to essential medical service (based on the number of inpatients)

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Supplementary Table 15

Trends in relevance index in Jeollanam-do by disease related to essential medical service (based on the number of inpatients)

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Supplementary Table 16

Trends in relevance index in Gyeongsangbuk-do by disease related to essential medical service (based on the number of inpatients)

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Supplementary Table 17

Trends in relevance index in Gyeongsangnam-do by disease related to essential medical service (based on the number of inpatients)

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Supplementary Table 18

Trends in relevance index in Jeju-do by disease related to essential medical service (based on the number of inpatients)

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