

# Performance trends and goal achievement of health indicators in Gyeongsangbuk-do and Daegu Metropolitan City

NamHyun Cha<sup>1</sup>, Mi Young Woo<sup>2</sup>, Sung Jung Hong<sup>1,\*</sup>

<sup>1</sup>Department of Nursing, College of Life Science · Health Welfare, Andong National University, Andong, Korea

<sup>2</sup>Department of Nursing, Hosan University, Gyeongsan, Korea

The core goal of South Korea's health policy is equity. To this end, regional disparities in health indicators must be identified. However, as an in-depth analysis of health disparities and health indicators in Gyeongsangbuk-do and Daegu Metropolitan City is lacking, this study examined the trends in performance and goal achievement in health indicators. Data collected from 2011 to 2022 for 31 cities and counties in the Gyeongbuk region (23 regions in Gyeongsangbuk-do and eight regions in Daegu Metropolitan City) were analyzed to examine 28 health indicators across three categories: health behavior, health outcomes, and healthcare utilization. The data were analyzed using SPSS/WIN 23.0.

The findings for health indicators showed significant and persistent gaps in health levels in Gyeongsangbuk-do, particularly in health behavior (31.3% and 68.7%), health outcomes (33.3% and 55.6%), and healthcare utilization (33.3% and 100%), in Gyeongsangbuk-do and Daegu Metropolitan City, respectively. Central government is vital for infrastructure development and financial assistance to effectively enhance health services in the local communities of Gyeongsangbuk-do.

**Keywords:** Community, Health disparities, Health behavior, Indicators, Health surveys, Gyeongsangbuk-do


## INTRODUCTION

Advancements in healthcare services have rapidly improved people's health. However, these improvements are not uniform across all population groups. According to the characteristics of residential areas, physical environment, social and psychological environment, and health behavioral traits, health disparities continue to persist. The reason for this is that an individual's health is influenced not only by their demographic characteristics but also by the material, social, psychological, and health behavioral characteristics of the community (Schwan, 2021). Social, economic, and political contexts shape an individual's socioeconomic position in terms of income, education, occupation, and location. These factors influence exposure and vulnerability to health interventions such as health behaviors, material environment, and sociopsychological aspects. Thus, the unequal distribution of social and re-

gional resources creates health inequalities, significantly impacting individual health levels (Peacock et al., 2014).

"Improving health equity" is a primary objective of South Korea's fourth Comprehensive National Health Promotion Plan is considered important as it encompasses the objective of "extending healthy life expectancy." Therefore, securing health equity is the core goal of South Korea's health policy. To reduce health disparities, active interventions are necessary in the healthcare sector, as well as in the political, economic, and social domains that influence health behaviors, thereby preventing any widening of regional health gaps. Ultimately, policies and institutional improvements should be implemented to address and alleviate health disparities (Gostin and Friedman, 2020). To achieve this, both central and local government policies and interventions are crucial.

In 1980, the Black Report in the United Kingdom addressed the importance of health behaviors among other factors causing

\*Corresponding author: Sung Jung Hong  <https://orcid.org/0000-0003-0255-8887>  
Department of Nursing, College of Life Science · Health Welfare, Andong National University, 1375 Gyeongdong-ro, Andong 36729, Korea  
Email: wjwsg@hanmail.net  
Received: August 15, 2024 / Revised: September 11, 2024 / Accepted: September 15, 2024

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<https://creativecommons.org/licenses/by-nc/4.0/>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

health inequalities, stating that health behaviors are distributed differently across social classes and that they can partially explain health inequalities (Macintyre, 1997). In 2008, the World Health Organization emphasized that reducing health inequities should expand beyond health issues and be addressed as a broader societal issue, drawing global attention to health policies and strategies based on the current inequalities in health status.

In 2007, South Korea initiated the Community Health Survey (CHS) as a pilot project targeting 20 cities, counties, and districts and expanded it to 254 regions. The CHS collects and observes health indicators annually to monitor regional health disparities. The Korea Disease Control and Prevention Agency (KDCA) regularly publishes “Regional Health Statistics at a Glance.” As a policy response to regional health disparities, eight regions (both metropolitan and basic local governments) with severe health disparities were selected as pilot areas since 2017 to identify the causes and develop solutions. However, policy research identifying and addressing the causes of regional health disparities remains unsatisfactory.

Previous studies on regional disparities reveal that groups with lower socioeconomic status, that is, low income and education levels, are less healthy with reduced life expectancy, and such groups benefit less from health improvements than those with higher status (Bahk et al., 2017; Khang and Kim, 2016). These groups also face higher risks of disease incidence and mortality, indicating health disparities (Subramania et al., 2001). Health inequality exists not only between urban and rural areas but also between the Seoul Metropolitan Area (centered around Seoul) and non-metropolitan regions, and within Seoul, specifically between the Gangnam and Gangbuk districts (Kim and Yoon, 2008; Lee et al., 2018). Furthermore, such inequities exist not only between regions but also within regions based on socioeconomic status which affect health behaviors such as smoking and obesity (Kim et al., 2018).

Gyeongsangbuk-do is a large administrative area, predominantly rural, with poor access to healthcare, resulting in significant differences in living standards. In fact, the province has become a superaged society, with the second-highest population of older adults among the 17 metropolitan and provincial regions in Korea. It also has the highest age-standardized mortality rate nationwide, and higher mortality rates than the national average for major chronic diseases, indicating significant regional disparities in health levels. Therefore, it is necessary to establish region-specific policies and strategies to address health disparities through prevention and research of chronic diseases in the Gyeongbuk region.

Recent studies have focused on socioeconomics (Blakely et al., 2002) and regional health disparities (Subramania et al., 2001). Although studies have focused on policy interventions and their impact, primarily aimed at addressing various health disparities between and within regions, there is a lack of in-depth research focusing on health disparities and trends in health indicators in Gyeongsangbuk-do and Daegu Metropolitan City. While the regional health statistics publication, *Regional Health Statistics at a Glance*, provides annual data on the overall health levels and key health indicators for each city, county, and district, including Gyeongsangbuk-do and Daegu Metropolitan City, in-depth analysis of region-specific requirements and detailed performance and trends in health indicators are lacking. This gap highlights the need for more comprehensive research to support the development of new health projects and policies to address health disparities and improve health outcomes in these regions. Evaluating the performance and achievement of health indicators in Gyeongsangbuk-do and Daegu Metropolitan City is key to not only for improving healthcare systems in the Gyeongbuk region (including Daegu), reducing health disparities, and enhancing the efficiency of resource allocation but also for developing effective health policies and promoting community health.

Therefore, this study compares Gyeongsangbuk-do and Daegu Metropolitan City to assess the extent of health disparities in Gyeongsangbuk-do. Additionally, by utilizing regional statistical data (such as the CHS) that examine trends in the performance and achievement of health indicators over a 12-year period, this study focused on identifying key health indicators with significant disparities between the two regions. This analysis provides essential foundational data for reducing health disparities and improving health among residents of the Gyeongbuk region and develops preventive health management strategies and health promotion policies.

This study examined the health issues and disparities between Gyeongsangbuk-do and Daegu Metropolitan City using the performance and achievement of health indicators over a 12-year period between 2011 and 2022, divided into the fifth to seventh phases of the CHS conducted by the KDCA. The specific study objectives are as follows: examine the trends in demographic factors. Assess the performance and achievement of health behavior indicators. Evaluate the performance and achievement of health outcome indicators. Analyze the performance and achievement of healthcare utilization indicators.

## MATERIALS AND METHODS

### Research design

This study analyzed the 12-year community-based sample survey data for Gyeongsangbuk-do and Daegu Metropolitan City, collected by the KDCA between 2011 and 2022. For the purpose of analysis, data were divided into 4-year intervals for analysis.

### Study participants

The study participants were drawn from 31 communities in Gyeongsangbuk-do and Daegu Metropolitan City (23 communities in Gyeongsangbuk-do and eight communities in Daegu Metropolitan City).

### Research data

The CHS data were divided into 3 periods of 4 years each, corresponding to the fifth to seventh phases of the regional health and medical plans. The following 29 health-related management indicators were measured for the Gyeongbuk region (including Daegu).

### Demographic factors (1 indicator)

Demographic factors referred to the population status and change rate at the city, county, and district levels for Gyeongsangbuk-do and Daegu, represented by a single indicator.

### Health behaviors (16 indicators)

Health behavior indicators included current smoking rate, current smoking rate for men, current smoking rate for smokers, monthly drinking rate, annual high-risk drinking rate for drinkers, rate of abstinence from drinking, walking practice rate, rate of practicing a healthy lifestyle, rate of practicing hand wash after going out, brushing practice rate after lunch, complaint rate of chewing discomfort rate (for those aged 65 years or above), prevention rate for skipping breakfast, obesity rate (self-reported), weight control attempt rate, drivers' seat belt wearing rate, and annual rate of drunken driving.

### Health outcomes (9 indicators)

Health outcomes included subjective health awareness rate, age-standardized mortality rate, hypertension diagnosis rate (for those aged 30 years or above), diabetes diagnosis rate (aged 30 years or above), treatment rate for those diagnosed with hypertension (aged 30 years or above), treatment rate for people diagnosed with diabetes (aged 30 years or above), stress recognition rate, depression

experience rate, and suicide rate.

### Healthcare utilization (3 indicators)

Healthcare utilization was measured using the annual rate of unmet medical care (patients and clinics), annual rate of complications in diabetic eye diseases, and the annual rate of diabetic kidney disease complications. The data were derived from the Korea Statistical Information Service (KOSIS) and the KDCA (CHS). Specifically, indicators for the country and Daegu Metropolitan City/Gyeongsangbuk-do region were utilized. All health indicators were obtained from the CHS.

### Data collection

The data collection process involved three stages to select the relevant health indicators: Step 1: data from the KDCA CHS and KOSIS were reviewed and 141 indicators were collected. Step 2: expert advisory meetings and intermediate evaluations were conducted to reduce the indicators to 104. Step 3: finally, a second round of expert advisory meetings resulted in 44 indicators. Although crucial for examining health trends in Gyeongsangbuk-do and Daegu Metropolitan City, a few indicators were excluded owing to data unavailability or restrictions on information disclosure. Accordingly, the indicators were categorized into four domains, 14 subcategories, and 35 indicators.

### Ethical considerations

The Institutional Review Board of Andong National University reviewed the study protocol and exempted it from ethical approval as it involved review and analysis of existing data (exemption number: 1040191-202401-HR-019-01).

### Data analysis

Data were analyzed using IBM SPSS Statistics ver. 23.0 (IBM Co., Armonk, NY, USA). Descriptive statistics, including frequencies, percentages, and means, were analyzed based on the research objectives and characteristics of the measured variables. The CHS indicators for cities, counties, and districts in Gyeongsangbuk-do and Daegu Metropolitan City were analyzed by dividing them into three periods, similar to the phases of the Community Health Care Plan: phase 5 (2011–2014), phase 6 (2015–2018), and phase 7 (2019–2022). Data were presented as age-standardized rates. To confirm the performance and goal achievement of community health indicators in the two regions, the latest value was evaluated as the seventh average, the reference value as the fifth average, and the target value as the seventh average na-

**Table 1.** Population status and growth rate (2011–2022)

Division	5th (2011–2014)									
	2011		2012		2013		2014		Mean	
	PS	GR	PS	GR	PS	GR	PS	GR	PS	GR
Nationwide	50,734,284	0.4	50,948,272	0.4	51,141,463	0.4	51,327,916	0.4	51,037,984	0.4
Gyeongsangbuk-do	2,699,195	0.3	2,698,353	0.0	2,699,440	0.0	2,700,794	0.1	2,699,446	0.1
Daegu Metropolitan City	2,507,271	-0.2	2,505,644	-0.1	2,501,588	-0.2	2,493,264	-0.3	2,501,942	-0.2
Division	6th (2015–2018)									
	2015		2016		2017		2018		Mean	
	PS	GR	PS	GR	PS	GR	PS	GR	PS	GR
Nationwide	51,529,338	0.4	51,696,216	0.3	51,778,544	0.2	51,826,059	0.1	51,707,539	0.3
Gyeongsangbuk-do	2,702,826	0.1	2,700,398	-0.1	2,691,706	-0.3	2,676,831	-0.6	2,692,940	-0.2
Daegu Metropolitan City	2,487,829	-0.2	2,484,557	-0.1	2,475,231	-0.4	2,461,769	-0.5	2,477,347	-0.3
Division	7th (2019–2022)									
	2019		2020		2021		2022		Mean	
	PS	GR	PS	GR	PS	GR	PS	GR	PS	GR
Nationwide	51,849,861	0.0	51,829,023	0.0	51,638,809	-0.4	51,439,038	-0.4	51,689,183	-0.2
Gyeongsangbuk-do	2,665,836	-0.4	2,639,422	-1.0	2,626,609	-0.5	2,600,492	-1.0	2,633,089	-0.7
Daegu Metropolitan City	2,438,031	-1.0	2,418,346	-0.8	2,385,412	-1.4	2,363,691	-0.9	2,633,090	-1.0

Source: National Statistics Portal Korea Statistical Information Service (Ministry of the Interior and Safety, Resident Registration Population Status).

Definition: Number of residents registered by local governments, as of the end of the year, aggregated by resident registration, excluding foreigners.

PS, population size; GR, growth rate.

tionwide. Achievement of greater than 100% of the goals was coded as achieved, less than 10% to 100% as improved, 0% to 10% as maintained, and less than 0% as deteriorated.

## RESULTS

### Demographic factors, population status, and decline rate

Population numbers for the country, Gyeongsangbuk-do, and Daegu Metropolitan City showed a continuous decreasing trend. Korea's population has been declining since 2021, while that of Gyeongsangbuk-do and Daegu Metropolitan City has been shrinking since 2016 and 2011, respectively. The average population decline rates during the fifth to seventh phases of the CHS were as follows: nationwide: -0.17%, Gyeongsangbuk-do: -0.27%, and Daegu Metropolitan City: -0.5% (Table 1).

### Health behaviors

Gyeongsangbuk-do achieved five indicators (31.3%) and improved in 11 indicators (68.7%), whereas Daegu Metropolitan City achieved 11 indicators (68.7%) and improved in five indicators (31.3%). Smokers' cessation attempt rate deteriorated in one (4.3%) region in Gyeongsangbuk-do, and the monthly drinking rate index (8.7%) was maintained in two regions of Gyeongsang-

buk-do and one region in Daegu Metropolitan City (12.5%). The annual indicator of the high-risk drinking rate of drinkers deteriorated in four regions (17.4%) in Gyeongsangbuk-do and in one region (12.5%) in Daegu Metropolitan City. In Gyeongsangbuk-do, five regions maintained the rate of attempts to quit drinking (21.7%), while four regions showed deterioration (17.4%). One region in Daegu Metropolitan City maintained the rate of attempting to quit smoking (12.5%), while three regions (37.5%) experienced deterioration. The walking practice rate index was maintained in four regions (17.4%) in Gyeongsangbuk-do, while it deteriorated in four regions (17.4%). In Daegu Metropolitan City, the walking practice rate index declined in one region (12.5%). The rate for following healthy lifestyle practices was maintained in three regions (13.0%), while it deteriorated in four regions (17.4%) in Gyeongsangbuk-do; in Daegu Metropolitan City, the behavior was maintained in one region (12.5%) and deteriorated in one (12.5%). In Gyeongsangbuk-do, 13 regions (56.5%) and one region (12.5%) in Daegu Metropolitan City showed a decline in the obesity rate. In Gyeongsangbuk-do, one region (4.3%) showed a deterioration in the weight control attempt rate index (Table 2).

**Table 2.** Performance and target achievement of health behavior indicators in North Gyeongsang Province

Indicator	Reference value	Performance and goal achievement				Total results	Evaluation results, No. of regions (%)			
		Target value	5th	6th	7th		A	I	M	D
Current smoking rate										
Nationwide	24.2		24.2	21.7	19.2					
Gyeongsangbuk-do	24.9	19.2	24.9	23.2	20.8	I	3 (13.0)	20 (87.0)	-	-
Daegu Metropolitan City	24.6		24.6	21.1	18.9	A	5 (62.5)	3 (37.5)	-	-
Current male smoking rate										
Nationwide	45.7		45.7	40.4	35.4					
Gyeongsangbuk-do	47.4	35.4	47.4	43.4	38.3	I	3 (13.0)	20 (87.0)	-	-
Daegu Metropolitan City	46.8		46.8	39.9	35.3	A	4 (50.0)	4 (50.0)	-	-
Current rate of smokers' attempts to quit smoking										
Nationwide	25.6		25.6	28.6	43.8					
Gyeongsangbuk-do	26.2	43.8	26.2	31.7	44.6	A	9 (39.1)	13 (56.5)	-	1 (4.3)
Daegu Metropolitan City	26.1		26.1	28.5	43.4	I	4 (50.0)	4 (50.0)	-	-
Monthly drinking rate										
Nationwide	59.8		59.8	61.4	56.8					
Gyeongsangbuk-do	58.0	56.8	58.0	60.1	55.8	I	10 (43.5)	9 (39.1)	2 (8.7)	-
Daegu Metropolitan City	61.3		61.3	61.1	55.0	I	6 (75.0)	1 (12.5)	1 (12.5)	-
High-risk drinking rate of annual drinkers										
Nationwide	17.9		17.9	19.0	15.4					
Gyeongsangbuk-do	17.7	15.4	17.7	19.2	16.6	A	9 (39.1)	10 (43.5)	-	4 (17.4)
Daegu Metropolitan City	15.4		15.4	15.6	13.5	I	5 (52.5)	2 (25.0)	-	1 (12.5)
Rate of attempt to abstain from alcohol										
Nationwide	13.3		13.3	12.4	13.7					
Gyeongsangbuk-do	13.2	13.7	13.2	14.0	17.0	A	11 (47.8)	3 (13.0)	5 (21.7)	4 (17.4)
Daegu Metropolitan City	11.5		11.5	10.1	14.2	A	3 (37.5)	1 (12.5)	1 (12.5)	3 (37.5)
Walking practice rate										
Nationwide	39.6		39.6	40.5	41.3					
Gyeongsangbuk-do	32.1	41.3	32.1	33.3	33.7	I	2 (8.7)	13 (56.5)	4 (17.4)	4 (17.4)
Daegu Metropolitan City	43.0		43.0	43.7	42.2	A	4 (50.0)	3 (37.5)	-	1 (12.5)
Health life style practice rate										
Nationwide	27.2		27.2	28.3	29.7					
Gyeongsangbuk-do	22.0	29.7	22.0	23.2	24.3	I	4 (17.4)	12 (52.2)	3 (13.0)	4 (17.4)
Daegu Metropolitan City	30.5		30.5	31.8	31.8	A	3 (37.5)	3 (37.5)	1 (12.5)	1 (12.5)
Practice rate of hand washing after going out										
Nationwide	80.6		80.6	81.6	92.0					
Gyeongsangbuk-do	77.2	92.0	77.2	81.3	90.7	I	7 (30.4)	16 (69.6)	-	-
Daegu Metropolitan City	78.0		78.0	88.2	94.3	A	8 (100.0)	-	-	-
Practice rate for brushing after lunch yesterday										
Nationwide	55.3		55.3	58.5	68.8					
Gyeongsangbuk-do	53.5	68.8	53.5	55.6	66.8	I	4 (17.4)	19 (82.6)	-	-
Daegu Metropolitan City	55.2		55.2	58.2	67.3	I	3 (37.5)	5 (62.5)	-	-
Complaint rate of chewing inconvenience ( $\geq 65$ )										
Nationwide	46.4		46.4	40.4	32.6					
Gyeongsangbuk-do	49.0	32.6	49.0	43.9	35.2	I	4 (17.4)	19 (82.6)	-	-
Daegu Metropolitan City	43.5		43.5	34.8	30.2	A	4 (50.0)	4 (50.0)	-	-

(Continued)

**Table 2.** Performance and target achievement of health behavior indicators in North Gyeongsang Province (Continued)

Indicator	Reference value	Performance and goal achievement				Total results	Evaluation results, No. of regions (%)			
		Target value	5th	6th	7th		A	I	M	D
Rate for the prevention of skipping meals in the morning										
Nationwide	68.6		68.6	63.6	49.4					
Gyeongsangbuk-do	71.4	49.4	71.4	63.9	60.1	A	5 (21.7)	18 (78.3)	-	-
Daegu Metropolitan City	68.4		68.4	65.1	50.8	A	1 (12.5)	7 (87.5)	-	-
Obesity rate (self-report)										
Nationwide	24.4		24.4	28.7	32.0					
Gyeongsangbuk-do	24.1	32.0	24.1	26.1	31.8	I	-	10 (43.8)	-	13 (56.2)
Daegu Metropolitan City	22.6		22.6	24.2	29.3	I	-	7 (77.5)	-	1 (12.5)
Weight control attempt rate										
Nationwide	55.5		55.5	60.3	65.6					
Gyeongsangbuk-do	52.6	65.6	52.6	58.5	63.2	I	4 (17.4)	18 (78.3)	-	1 (4.3)
Daegu Metropolitan City	57.7		57.7	61.9	66.0	A	4 (50.0)	4 (50.0)	-	-
Driver seat belt wearing rate										
Nationwide	76.6		76.6	84.7	90.6					
Gyeongsangbuk-do	69.2	90.6	69.2	78.0	85.3	I	2 (8.7)	21 (91.3)	-	-
Daegu Metropolitan City	85.3		85.3	92.5	95.4	A	8 (100.0)	-	-	-
Rate of driving after drinking										
Nationwide	12.8		12.8	10.2	2.9					
Gyeongsangbuk-do	16.1	2.9	16.1	13.4	4.3	A	5 (21.7)	18 (78.3)	-	-
Daegu Metropolitan City	13.1		13.1	9.0	2.3	A	7 (87.5)	1 (12.5)	-	-

Baseline: 5th-year national, Gyeongsangbuk-do and Daegu Metropolitan City average value. Target: 7th-year national average value benchmark. 5th: 2011–2014. 6th: 2015–2018. 7th: 2019–2022.

Achievement rate = (target value – baseline value recent value – baseline value) × 100.

A, achievement; I, improvement; M, maintained; D, deterioration.

## Health outcomes

Gyeongsangbuk-do achieved three indicators (33.3%), improved in five (55.6%), and deteriorated in one indicator (11.1%). Daegu Metropolitan City achieved five indicators (55.6%) and improved four indicators (44.4%). In Gyeongsangbuk-do, two regions (11.1%) maintained and five (21.7%) deteriorated. In Daegu Metropolitan City, one region (12.5%) deteriorated in the subjective health awareness indicators. In Gyeongsangbuk-do, there were 10 regions (43.5%) in which the hypertension diagnosis experience rate (over 30 years old) deteriorated; it was maintained in one region and deteriorated in four regions in Daegu Metropolitan City (50.0%). In Gyeongsangbuk-do, 11 regions (47.8%) showed worsened diabetes diagnosis experience rate (over 30 years of age), while the same was observed in three regions (37.5%) in Daegu Metropolitan City. The treatment rate among individuals diagnosed with diabetes decreased in two regions (8.7%) of Gyeongsangbuk-do. In two areas of Gyeongsangbuk-do (8.7%) the stress perception rate index was maintained, and it had worsened in three areas (13.0%). In Gyeongsangbuk-do, three regions (13.0%) maintained the depression experience index while 13 re-

gions (56.6%) showed deterioration; in Daegu Metropolitan City, four regions (50.0%) showed deterioration in the depression experience index. The data indicated that: five regions (21.7%) in Gyeongsangbuk-do showed deterioration in the suicide attempt rate indicator. Three regions (37.5%) of Daegu Metropolitan City maintained a similar suicide attempt rate (Table 3).

## Healthcare utilization

Of the three healthcare utilization indicators, Gyeongsangbuk-do achieved one indicator (33.3%) and showed improvement in two indicators (66.6%). In Daegu Metropolitan City, all three indicators had improved (100.0%). The index for annual diabetic eye disease complication test progress was maintained in three regions (13.0%) and deteriorated in eight regions (34.8%) in Gyeongsangbuk-do; whereas, it deteriorated in two regions (25.0%) in Daegu Metropolitan City. The annual diabetic kidney disease complication test progression rate was maintained in three regions (13.0%) and deteriorated in three regions (13.0%) in Gyeongsangbuk-do (Table 4).

**Table 3.** Performance and achievement of health outcome indicators in Gyeongsangbuk-do

Indicator	Reference value	Performance and goal achievement				Total results	Evaluation results, No. of regions (%)			
		Target value	5th	6th	7th		A	I	M	D
Subjective health perception rate										
Nationwide	45.6		45.6	44.4	48.8					
Gyeongsangbuk-do	41.8	48.8	41.8	40.5	45.9	I	4 (17.4)	12 (52.2)	2 (8.7)	5 (21.7)
Daegu Metropolitan City	43.9		43.9	41.3	49.2	A	4 (50.0)	3 (37.5)	-	1 (12.5)
Age-standardized mortality rate										
Nationwide	379.6		379.6	332.9	307.8					
Gyeongsangbuk-do	410.6	307.8	410.6	358.8	334.5	A	1 (4.3)	22 (95.7)	-	-
Daegu Metropolitan City	391.3		391.3	346.8	316.4	A	1 (12.5)	7 (87.5)	-	-
Prevalence of diagnosed hypertension (age ≤ 30)										
Nationwide	18.9		18.9	19.5	19.6					
Gyeongsangbuk-do	17.7	19.6	17.7	19.0	19.1	I	-	12 (52.2)	1 (4.3)	10 (43.5)
Daegu Metropolitan City	17.6		17.6	17.7	17.9	I	1 (12.5)	3 (37.5)	4 (50.0)	-
Prevalence of diagnosed diabetes (age ≤ 30)										
Nationwide	7.3		7.3	7.9	8.5					
Gyeongsangbuk-do	6.8	8.5	6.8	7.8	8.4	I	-	12 (52.2)	-	11 (47.8)
Daegu Metropolitan City	7.0		7.0	7.8	8.1	I	-	5 (62.5)	-	3 (37.5)
Treatment rate among individuals diagnosed as hypertensive (age ≥ 30)										
Nationwide	88.3		88.3	89.3	92.8					
Gyeongsangbuk-do	88.3	92.8	88.3	89.5	92.5	I	10 (43.5)	13 (56.5)	-	-
Daegu Metropolitan City	87.9		87.9	89.6	93.1	A	4 (50.0)	4 (50.0)	-	-
Treatment rate among individuals diagnosed as diabetic (age ≥ 30)										
Nationwide	85.2		85.2	87.2	91.7					
Gyeongsangbuk-do	87.1	91.7	87.1	89.3	93.3	A	12 (52.2)	9 (39.1)	-	2 (8.7)
Daegu Metropolitan City	86.7		86.7	88.9	92.5	A	2 (25.0)	6 (75.0)	-	-
Perceived stress rate										
Nationwide	27.8		27.8	27.4	25.4					
Gyeongsangbuk-do	25.5	25.4	25.5	25.2	24.4	I	7 (30.4)	11 (47.8)	2 (8.7)	3 (13.0)
Daegu Metropolitan City	26.8		26.8	25.2	23.8	I	5 (52.5)	3 (37.5)	-	-
Prevalence of depression										
Nationwide	5.2		5.2	5.6	6.2					
Gyeongsangbuk-do	4.9	6.2	4.9	5.8	6.4	D	3 (13.0)	4 (17.4)	3 (13.0)	13 (56.6)
Daegu Metropolitan City	5.1		5.1	4.5	5.7	I	2 (25.0)	2 (25.0)	-	4 (50.0)
Suicide rate										
Nationwide	25.7		25.7	22.0	22.0					
Gyeongsangbuk-do	26.7	22.0	26.7	23.1	23.8	A	6 (26.1)	12 (52.2)	-	5 (21.7)
Daegu Metropolitan City	24.1		24.1	21.9	23.0	A	3 (37.5)	2 (25.0)	3 (37.5)	-

Baseline: 5th national, Gyeongsangbuk-do and Daegu Metropolitan City average value. Target: 7th national average value benchmark. 5th: 2011–2014. 6th: 2015–2018. 7th: 2019–2022.

Achievement rate = (target value – baseline value recent value – baseline value) × 100.

A, achievement; I, improvement; M, maintained; D, deterioration.

## DISCUSSION

Using raw data collected between 2011 and 2022 by the CHS and KOSIS, this study attempted to identify the health inequality status between Gyeongsangbuk-do and Daegu by examining

trends in demographic factors, health behaviors, health outcomes, medical use status performance, and goal achievement in cities, counties, and districts.

In terms of demographic characteristics, particularly population size and growth rate, Gyeongsangbuk-do has a high population

**Table 4.** Performance and target achievement of medical use indicators in Gyeongsangbuk-do

Indicator	Reference value	Performance and goal achievement				Total results	Evaluation results, No. of regions (%)			
		Target value	5th	6th	7th		A	I	M	D
Annual unmet medical care rate (hospital/clinic)										
Nationwide	12.7		12.7	10.9	5.6					
Gyeongsangbuk-do	12.9	5.6	12.9	11.9	6.0	A	11 (47.8)	12 (52.2)		
Daegu Metropolitan City	13.2		13.2	8.7	4.8	I	4 (50.0)	4 (50.0)		
Annual diabetic eye complication examination rate										
Nationwide	30.5		30.5	33.4	43.6					
Gyeongsangbuk-do	32.3	43.6	32.3	35.5	36.1	I	3 (13.0)	9 (39.1)	3 (13.0)	8 (34.8)
Daegu Metropolitan City	34.5		34.5	39.1	40.7	I	1 (12.5)	5 (62.5)		2 (25.0)
Annual diabetic kidney complication examination rate										
Nationwide	31.1		31.1	38.5	49.0					
Gyeongsangbuk-do	31.0	49.0	31.0	40.8	40.4	I	1 (4.3)	16 (91.3)	3 (13.0)	3 (13.0)
Daegu Metropolitan City	30.8		30.8	43.9	48.7	I	5 (62.5)	3 (37.5)		

Baseline: 5th national, Gyeongsangbuk-do and Daegu Metropolitan City average value. Target: 7th national average value benchmark. 5th: 2011–2014. 6th: 2015–2018. 7th: 2019–2022.

Achievement rate = (target value – baseline value recent value – baseline value) × 100. A, achievement; I, improvement; M, maintained; D, deterioration.

decline rate (ranking second nationwide). This indicates a significant disparity in population compared to the Seoul Metropolitan Area, thus highlighting the severe imbalances in regional population in Gyeongsangbuk-do. Note that Gyeongsangbuk-do has the second-highest proportion of individuals aged 65 years or above in South Korea (23.9%) and is now designated as a “superaged society.” Therefore, national and regional policy measures that address economic and health disparities in older residents are imperative. South Korea has implemented a 5-year basic plan since 2006 to address issues related to declining birth rates, aging, and population decline. However, owing to the temporary nature of the policies and limited financial investments, the birth rate has not improved. Therefore, solutions that address the root causes of low birth rates should be developed rather than temporary measures.

Among the 16 indicators of health behavior, Gyeongsangbuk-do achieved five indicators (31.3%) and improved 11 (68.7%), and Daegu Metropolitan City achieved 11 indicators (68.7%) and improved five (31.3%). Among the health behavior indicators, Daegu Metropolitan City had five indicators (1.4 regions on average), whereas Gyeongsangbuk-do had seven indicators (4.4 regions on average), indicating that the health behavior of Gyeongsangbuk-do residents did not show improvement compared to that of Daegu Metropolitan City residents. Among health behaviors, self-reported obesity rate was the most deteriorating indicator in Gyeongsangbuk-do, observed in 13 cities, counties, and districts (56.2%). Thus, projects focused on obesity rate improvement should be accorded highest priority among health behaviors. The annual high-

risk drinking rate, attempt to abstain from consuming alcohol, walking practice rate, and healthy life practice rate deteriorated in four cities, counties, and districts (17.4%) in Gyeongsangbuk-do. However, in Daegu Metropolitan City, abstaining from alcohol consumption showed the highest deterioration (three regions, 37.5%), followed by one region in annual high-risk drinking rate, walking practice rate, healthy life practice rate, and obesity rate (self-report). The obesity rate (self-reported) shows an annually increasing trend, similar to the national average. The primary cause of obesity is decreased physical activity. The increase in obesity rates during the seventh phase, which coincided with the coronavirus disease 2019 (COVID-19) pandemic, can be attributed to the following factors. First, changes in lifestyle patterns such as social isolation and reduced outings significantly contributed toward an increase in obesity. Second, the boom in home delivery services during the pandemic (Li et al., 2022) in South Korea increased the consumption of food and meal kit products. This shift from cooking at home to dining out or ordering may result in obesity changes. Robinson et al. (2021) revealed an increase in body mass index during the COVID-19 isolation period; it is likely that the reduction in physical activity and changes in eating patterns contributed to an increase in obesity rates. Obesity is the root cause of many diseases and is associated with a metabolic syndrome, diabetes, coronary artery disease, and cancer (Robinson et al., 2021). Therefore, reducing the obesity rate is crucial for preventing chronic diseases. Improving health-related behaviors and implementing programs that target obesity reduction are essential



to address this issue.

Three of the nine health outcome indicators deteriorated in Daegu Metropolitan City (average: 2.7 regions, 33.3%); whereas seven (average of the seven regions: 30.4%) declined in Gyeongsangbuk-do. Health results did not show more improvement in Gyeongsangbuk-do than in Daegu Metropolitan City. The most common indicators of exacerbation in Gyeongsangbuk-do was depression (13 regions, 56.6%), followed by diabetes (11 regions, 47.8%), high blood pressure (10 regions, 43.5%), subjective health awareness (five regions, 21.7%), suicide rate (five regions, 21.7%), stress awareness rate (three regions, 13.0%), and treatment rate (two regions, 8.7%) for those diagnosed with diabetes and over 30 years of age. In Daegu Metropolitan City, highest exacerbation was observed in depression (four regions, 50.0%), followed by diabetes (three regions, 37.5%), and subjective health awareness (one region, 12.5%). Evidently, the prevalence of depressive symptoms has steadily increased, similar to the national trend. There is a significant association between the COVID-19 pandemic and depressive symptoms (Ettman et al., 2020), and the worsening of depressive symptoms during the seventh phase may be attributed to its overlap with the pandemic period. Additionally, the outbreak of the Middle East respiratory syndrome in 2015 coincided with the sixth term, indicating a possible association between the increase in depressive symptoms from the sixth to the seventh phases following the outbreak of the infectious disease. These findings suggest that social isolation and the acute impact of infectious diseases may have heightened the sense of crisis and increased depressive symptoms (Leigh-Hunt et al., 2017). Depression can have adverse outcomes on health through mechanisms such as cardiovascular diseases and elevated blood pressure (Bludorn and Railey, 2024), and can also affect the management of chronic conditions such as hypertension, diabetes, and suicide. Therefore, mental health interventions that aim to improve depressive symptoms are crucial.

Of the three healthcare utilization indicators, two (average: 5.5 regions, 23.9%) deteriorated in Gyeongsangbuk-do, while one (average: two regions, 25.0%) in Daegu. It is evident that healthcare utilization did not improve as much in Gyeongsangbuk-do as in Daegu Metropolitan City. Among the healthcare utilization indicators, the most significant deterioration in Gyeongsangbuk-do was observed in the annual diabetes-related eye disease complication examination rate (eight regions, 34.8%) and annual diabetes-related kidney disease complication examination rate (three regions, 13.0%). In contrast, Daegu Metropolitan City experienced a deterioration in the annual diabetes-related eye disease complication examination rate (two regions, 25.0%). In the Gyeongsangbuk-do

region (including Daegu), diagnosis rates for both hypertension and diabetes have continuously increased, similar to the national trend. In the Gyeongsangbuk-do region (including Daegu), treatment rates for individuals diagnosed with hypertension and diabetes have remained high at over 90% since the seventh phase, and the increasing rates are of concern. Additionally, the annual screening rates for diabetic retinopathy and nephropathy complications are lower than the national average, highlighting the need for attention and improvement in these areas. Management of hypertension and diabetes can prevent metabolic diseases and complications. Therefore, physical activity, lifestyle changes, and screening tests are important for managing chronic diseases (e.g., high blood pressure and diabetes), and continuity is required when conducting improvement projects. Through this study, it is evident that the Gyeongbuk region, particularly Gyeongsangbuk-do, is challenged by severe health disparities than Daegu Metropolitan City, with a greater number of communities experiencing worsening of health indicators. This study has also identified that psychological disorders, such as depression and obesity, and chronic diseases, such as hypertension and diabetes, are indicators that require continuous improvement efforts in Gyeongsangbuk-do.

This study has attempted to report stable changes in indicators by comparing average values over 12 years; however, a limitation is that it is difficult to separately interpret the social variables of COVID-19, and a comparison with recent years could not be conducted. Additionally, the analysis period was short (four months), and this has constrained the analysis to only 28 basic research indicators (intervention factors), resulting in recommendations for only limited indicator improvement projects.

## CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

## ACKNOWLEDGMENTS

This research was supported by a grant (code#2023-16-002) from the research of the Korea Disease Control and Prevention Agency (2023).

## REFERENCES

Bahk J, Lynch JW, Khang YH. Forty years of economic growth and plummeting mortality: the mortality experience of the poorly educated in

- South Korea. *J Epidemiol Community Health* 2017;71:282-288.
- Blakely TA, Lochner K, Kawachi I. Metropolitan area income inequality and self-rated health—a multi-level study. *Soc Sci Med* 2002;54:65-77.
- Bludorn J, Railey K. Hypertension guideline and intervention. *Primary Care* 2024;51:41-52.
- Ettman CK, Abdalla SM, Cohen GH, Sampson L, Viver PM, Galea S. Prevalence of depression symptoms in US adults before and during the COVID-19 pandemic. *JAMA Netw Open* 2020;3:e2019686.
- Gostin LO, Friedman EA. Health inequalities. *Hastings Cent Rep* 2020; 50:6-8.
- Khang YH, Kim HR. Socioeconomic Inequality in mortality using 12-year follow-up data from nationally representative surveys in South Korea. *Int J Equity Health* 2016;15:51.
- Kim I, Bahk J, Kim YY, Lee J, Kang HY, Lee J, Yun SC, Park JH, Shin SA, Khang YH. Prevalence of overweight and income gaps in 245 districts of Korea: comparison using the national health screening database and the community health survey, 2009-2014. *J Korean Med Sci* 2018;33:e3.
- Kim JH, Yoon TH. Comparisons of health inequalities in small areas with using the standardized mortality ratios in Korea. *J Prev Med Public Health* 2008;41:300-306.
- Lee J, Bahk J, Kim I, Kim YY, Yun SC, Kang HY, Lee J, Park JH, Shin SA, Khang YH. Geographic variation in morbidity and mortality of cerebrovascular diseases in Korea during 2011-2015. *J Stroke Cerebrovasc Dis* 2018;27:747-757.
- Leigh-Hunt N, Baguley D, Bash K, Turner V, Turnbull S, Vaitorta N. An overview of systematic reviews on the public health consequences of social isolation and loneliness. *Public Health* 2017;152:157-171.
- Li YZ, Yao P, Osman S, Zainudin N, Sabri MF. A thematic review on using food delivery service during the pandemic: insights for the post-COVID-19. *Int J Environ Res Public Health* 2022;19:15267.
- Macintyre S. The black report and beyond what are the issues? *Soc Sci Med* 1997;44:723-745.
- Peacock M, Bissrill P, Owen J. Dependency denied: health inequalities in the neo-liberal era. *Soc Sci Med* 2014;118:173-180.
- Robinson E, Boyland E, Chisholm A, Harrold J, Maloney NG, Marty L, Mead BR, Noonan R, Hardman CA. Obesity, eating behavior and physical activity during COVID-19 lockdown: a study of UK adults. *Appetite* 2021;156:104853.
- Schwan B. Responsibility amid the social determinants of health. *Bioethics* 2021;35:6-14.
- Subramania SV, Kawachi I, Kennedy BP. Does the state you live in make a difference? Multilevel analysis of self-rated health in the US. *Soc Sci Med* 2001;53:9-19.