Analysis of the Impact of the Telemedicine Program for Medically Underserved Area on Hospitalization rates among Diabetic Patients in Medically Underserved Area

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INTRODUCTION

To reduce health disparities among individuals living in rural areas, the Ministry of Health and Welfare of South Korea has been implementing a telemedicine program (TP) for medically underserved areas (MUAs) in collaboration with the Korea Health Promotion Institute since January 2017.

OBJECTIVES

We evaluated the impact of the government's TP by examining whether diabetes-related hospitalization (DRH) rates among diabetic patients in 45 MUAs decreased after its implementation.

METHODS

- Using the National Health Insurance Service (NHIS) Sample Cohort—comprising 2.2% of Korea's 2006 population stratified by age, sex, insurance type, and income—we constructed annual cohorts of diabetic patients aged ≥50 from 2014 to 2019. The NHIS sample cohort data provide basic sociodemographic information (e.g., age, gender, residential area) and claims records for medical services received.
- For each annual cohort, we calculated the annual DRH rate in both MUAs and non-medically underserved areas (195 NMUAs), defined as the proportion of diabetic individuals experiencing a DRH each year. Changes in DRH rates over time were compared between MUAs and NMUAs.
- Furthermore, MUAs were classified into tertiles of High, Moderate, and Low based on the degree of TP utilization drawn from the "2019 Report on the Telemedicine Program for Medically Underserved Areas" by the Korea Health Promotion Institute. We calculated the annual per-capita telemedicine rate for each MUA by dividing the total annual number of telemedicine visits by the number of participants for TP.
- MUAs ranked 1–15 by per-capita rate were classified as high utilization, those ranked 16–30 as moderate utilization, and those ranked 31–45 as low utilization.

$$TUL_i = \frac{C_i}{N_i}$$

TUL_i = Telemedicine Utilization Level in medically underserved area *I*, C_i = Annual number of telemedicine in medically underserved area *I*, N_i = Number of program participants in medically underserved area *I, i=1,…,45*

RESULTS

- From 2014 to 2019, DRH rates in MUAs remained consistently higher than in NMUAs, although both showed a declining trend (Figure 2).
- In MUAs, the DRH rate decreased modestly from 11.36% in 2014 to 10.61% in 2016 (a 6.6% reduction). Following the TP implementation, the rate declined substantially to 8.06% in 2019 (a 24.03% reduction from 2016) (Figure 2, Table 1).
- In NMUAs, DRH fell from 9.44% in 2014 to 9.17% in 2016, and further to 7.78% in 2019 (a 15.1% post-2016 reduction) (Figure 2, Table 1).
- Among MUAs, the high-utilization group saw the greatest DRH reduction (37.2%) from 2016 to 2019, compared to the moderate (8.7%) and low-utilization groups (27.8%), suggesting a dose-response relationship between program usage and outcomes.

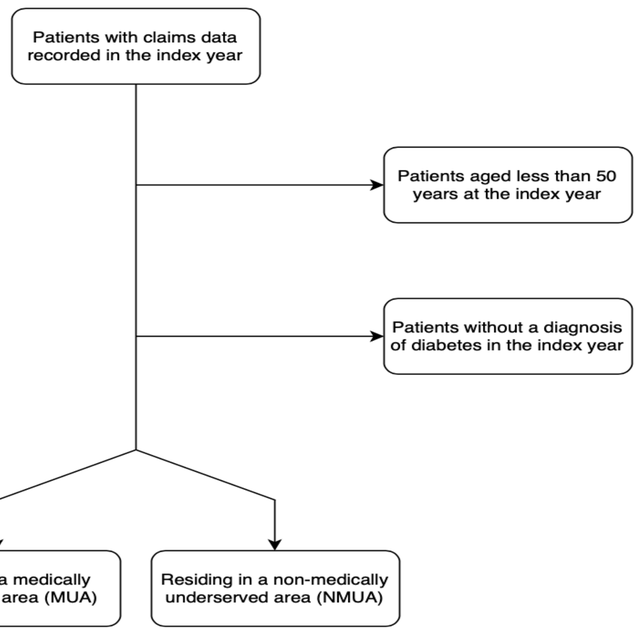


Figure 1. Flowchart for identifying the study subjects

ICD-10 codes for diabetes mellitus: E10, E10.0, E10.1, E10.2, E10.3, E10.4, E10.5, E10.6, E10.7, E10.8, E10.9, E11, E11.0, E11.1, E11.2, E11.3, E11.4, E11.5, E11.6, E11.7, E11.8, E11.9, E12, E12.0, E12.1, E12.2, E12.3, E12.4, E12.5, E12.6, E12.7, E12.8, E12.9, E13, E13.0, E13.1, E13.2, E13.3, E13.4, E13.5, E13.6, E13.7, E13.8, E13.9, E14, E14.0, E14.1, E14.2, E14.3, E14.4, E14.5, E14.6, E14.7, E14.8, E14.9, R81

SGG codes for Medically Underserved Area: 28710, 41650, 42110, 42130, 42150, 42190, 42230, 42720, 42730, 42750, 42760, 42770, 42790, 42780, 42790, 42810, 42820, 42830, 44180, 44210, 44710, 44770, 44800, 45210, 45710, 46780, 46880, 46890, 46900, 46910, 47130, 47150, 47210, 47750, 47900, 47920, 48110, 48240, 48720, 48730, 48840, 49110, 49130, 50110, 50130

DISCUSSION

The TP led to greater reductions in diabetes-related hospitalizations in MUAs than in non-MUAs. Higher TP utilization within MUAs was linked to more pronounced improvements, supporting the program's effectiveness and the need for its continued expansion in underserved regions.

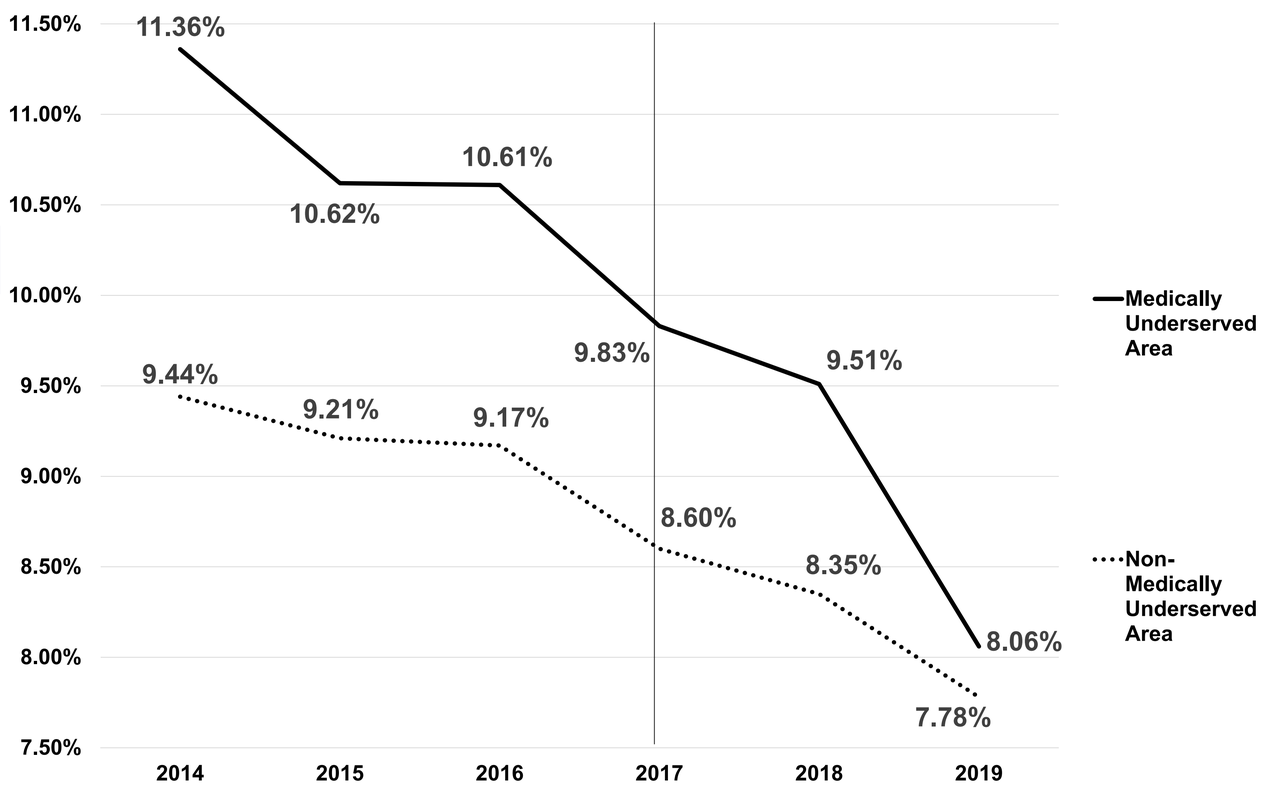
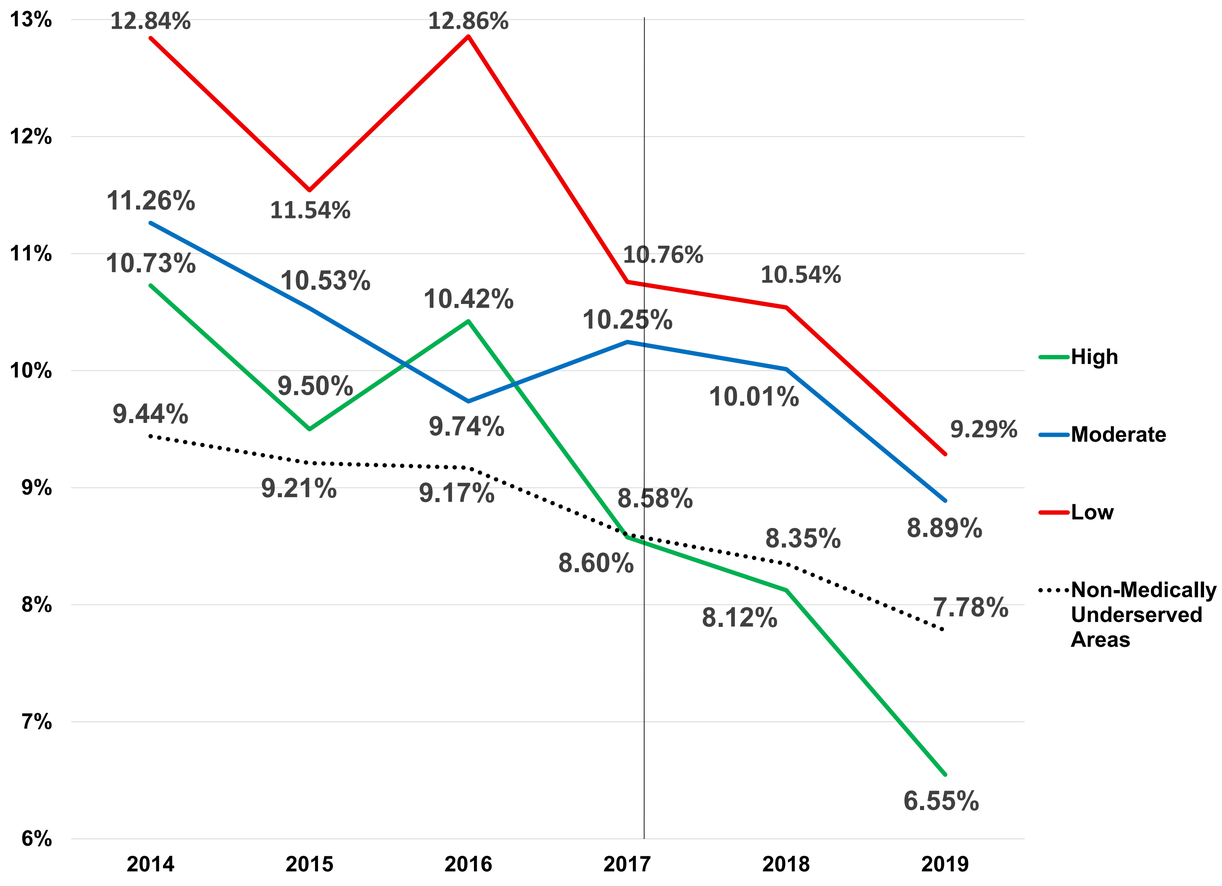


Figure 2. Diabetes-related Hospitalization Rates in Medically Underserved Area vs. Non-Medically Underserved Area



High: Among MUAs where telemedicine programs have been implemented, denotes areas exhibiting the highest level of utilization, Moderate: Among MUAs where telemedicine programs have been implemented, denotes areas exhibiting a moderate level of utilization, Low: Among MUAs where telemedicine programs have been implemented, denotes areas exhibiting the lowest level of utilization

Figure 3. Diabetes-related Hospitalization Rates According to the Extent of Telemedicine Utilization in Medically Underserved Areas

Table 1. Comparison of Diabetes-related Hospitalization Rates in Medically Underserved Areas According to the Extent of Telemedicine Implementation: 2016 vs 2019

	Area (Total region)	2016 (%)	2019 (%)	Change, 2019 vs. 2016 (%)
MUA	45	10.61	8.06	-24.03
High	13	10.42	6.55	-37.20
Moderate	14	9.70	8.89	-8.70
Low	12	12.86	9.29	-27.80
NMUA	195	9.17	7.78	-15.10

Several MUAs had fewer than 500 subjects per year in the NHIS cohort sample, necessitating consolidation with adjacent regions. These areas were excluded from analysis due to potential misinterpretation of the program's effectiveness.

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