Non-COVID-19 Healthcare Utilisation for Elderly People at the Onset of the COVID-19 Pandemic in Korea

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Abstract

Background: At the onset of the coronavirus disease 2019 (COVID-19) pandemic, health care systems were severely disrupted in many countries and in particular, elderly people vulnerable to COVID-19 may have been reluctant to receive their medical treatment.

Methods: We conducted interrupted time series analyses (ITSA) using nationwide medical utilization data, with focus on different disease categories for the patients of 65–84-year-olds, i.e., acute upper respiratory infections (AURIs) vs. chronic diseases.

Results: AURIs and chronic diseases showed a sharp contrast with respect to the change in healthcare service utilisation. First, the utilisation rate for chronic diseases changed little whereas for AURIs it dropped by 20.4% year-over-year (yoy) at the onset of the pandemic (week 6, 2020). Second, as social distancing relaxed (week 17, 2020), the AURIs patients trended up and even reached to 7.8% above yoy whereas no significant change found for chronic diseases.

Conclusions: The uninterrupted treatment for chronic diseases in contrast to the AURIs implies that the governmental and public responses to the pandemic outbreak worked for efficient healthcare provision to non-COVID patients as well as effective slowdown against the COVID transmission.

Introduction

In many countries, there has been a considerable decline in health care use by non-coronavirus disease 2019 (COVID-19) patients (¹; ²; ³; ⁴; ⁵). Some health care facilities could not sustain the pre-pandemic level of services because their resources shifted towards the COVID-19 patients, and some facilities were shut down to avoid disease transmission. In addition, people were reluctant visit medical institutions because of the fear of infection. Social distancing policies such as stay-at-home orders, which limit the movement of people, also hindered medical facility utilisation. Given this situation, the use of essential medical services, not to mention elective services, decreased ⁶; for example, by 38% for severe heart attack patients treated in nine major hospitals in the U.S. ⁷, 64% in paediatric emergency room visits in Germany ⁸, and 50% reductions in emergency departments visits in Italy ⁹.

Restricted access to health care facilities usually has the greatest impact on the most vulnerable groups. In particular, older people might be more at higher risk of poor outcomes owing to reduced or delayed healthcare services because they tend to have co-morbidities and chronic diseases associated with complications when timely care is not provided (¹⁰; ¹¹; ⁶). Elderly individuals with pre-existing chronic illnesses, such as, cardiovascular disease, renal failure, cerebrovascular disease, respiratory disease, cancer, and diabetes, are more prone to the risk of mortality (¹²; ¹³; ¹⁴). Moreover, elderly people with chronic diseases are inevitably have greater fear of infection and are more likely to refrain from utilising medical care ¹⁵.

If patients with chronic diseases (or others in need of ongoing care) defer or delay hospital visits due to the fear of acquiring COVID-19 or the lack of hospital capacity, then this may have long-term negative effects on their health ^{16–18}. Moreover, the undesirable health outcomes may be more pronounced for older people. Patients with diabetes have a high risk of severe complications including adult respiratory distress syndrome and multi-organ failure ¹⁹. Previous studies also found the management of high blood pressure and diabetes in elderly people is closely related to hospitalisation for related injuries, emergency room visits, and health care costs (²⁰; ²¹; ²²).

However, among the studies which have explored healthcare utilisation during the COVID-19 pandemic, only few have focused on non-COVID 19 health care for elderly people. This study investigated whether elderly people (age range: 65–84 years old), who have a higher demand for medical services and are the most frequent visitors to hospitals, had changes in their utilisation of hospital services during the outbreak of COVID-19 pandemic.

Korea is one of the most successful countries that showed an initial response to COVID-19 (^{23; 24; 25; 26}). Because of the large-scale outbreak in Shincheonji, Daegu, starting on February 18, 2020, the number of newly confirmed cases per day peaked at 1,062 on March 1, followed by a period of sustained transmission ²⁷. However, the daily average number of newly infected patients from March 15 to September 30 was 79.8 ²⁸ and the number remained stable without travel restrictions or lockdown. In this context, Korea can provide a good example for reviewing the changes in medical facility utilisation during the COVID-19 pandemic and the related policy effect. Korea had relatively fewer barriers than other countries, wherein social distancing were mandated. Therefore, this study investigated the changes in healthcare utilisation for the older population of Korea using nationwide data for individuals with different types of diseases to examine the unexpected endemic event on healthcare utilisation. The different stage of pandemic is expected to reflect the extent of COVID-19 spread and follow the stages of control measures in Korea.

Methods

Datasets

This study utilised Korea's National Health Insurance (NHI) claims data. Because this dataset includes data of the entire national population and all medical institutions are designated as providers, the NHI claims database represents the population's utilisation of medical care and has been used to estimate the prevalence and incidence of diseases in Korea.

This study targeted data from January 2020 to July 2020, and for comparison, a dataset containing data from January 2017 to December 2019 was constructed. It takes a certain amount of time for a hospital's claims to be registered in the NHI data system, and the larger hospitals tend to claim multiple cases at once. Therefore, there is a delay between the actual date of medical care and the date in the system that indicates utilisation. To address this problem, we extracted the data after six months later (when the care was received on by July 31, 2020, and the data was extracted on December 18th, 2020) since almost 95% of claims are reported within six months²⁹. The statistical analysis was conducted using STATA SE/14.2.

Disease categories

For patients who visited the medical institutions taking ambulatory services during those periods, we extracted the claims with acute upper respiratory infections (AURIs), cancer, diabetes, or high blood pressure as the main and first sub-diagnosis. We identified the patient visit records pertaining to AURIs according to the code J00-J06, from the International Statistical Classification of Diseases and Related Health Problems (ICD). We considered diabetes (ICD-10 codes: E10, E11, E12, E13, E14) and high blood pressure (ICD-10 codes: I10, I11, I12, I13, I14, I15) as two representative chronic diseases. Lastly, we use the data regarding cancer (denoted as "C" in the ICD-10 codes).

Treated and Control Group

We chose AURIs as the treatment group for an interrupted time series analysis (ITSA) because respiratory diseases have similar symptoms as those of COVID-19 and the level of "infectiousness" is usually inferred based on the amount of viral shedding from the upper respiratory tract in patients ³⁰. The fear and uncertainty around COVID-19 might have led people to refrain from physical and social interaction, which would help to reduce the spread of AURIs. Moreover, the anxiety of visiting a hospital for a minor illness might have kept the elderly population from seeking hospital services. Therefore, a substantial reduction in the incidence of AURIs could have implications for COVID-19 responses ³¹.

However, the incidence of chronic disease is independent of the COVID-19 pandemic and social distancing measures. Furthermore, individuals with chronic diseases visit the hospital regularly for prescriptions and check-ups. Healthcare utilisation according to chronic disease type can indicate whether hospital visits from elderly people have been affected by the COVID-19 pandemic due to the fear of infection or social distancing. In addition, there might be decreases in diagnoses because mandatory health check-ups have been delayed or deferred. Considering this, our results might underestimate the hospital visits associated with chronic diseases. The medical needs of patients with cancer might not be affected by the

COVID-19 pandemic, but because of the fear of acquiring COVID-19, patients may avoid in-person visits to the hospital and postpone their appointments ³².

Statistical Analysis

Empirical methodology

Single ITSA

We set two interventions; the first intervention time as the first week of February 2020(week 6, 2020), when the first COVID-19 case in Korea was reported in week 5, 2020; because of the high fear of acquiring it and uncertainty on COVID-19 in Korea, there was a shortage of N95 masks and hand sanitisers; the second intervention time was set at the fourth week of April, 2020(week 17, 2020), when the level of social distancing was relaxed after the number of new COVID-19 cases decreased to less than 20^[1]. We performed a single-group ITSA using Newey-West robust errors with one lag, on the year-over-year(YOY) growth rate in the number of patients per week related to each disease as the dependent variable.

Outcome measures

Outcome measures of interests in this study is the year-over-year(YOY) growth rate in the number of patients per week. To begin with, we examine the level change of the YOY growth rate by two interventions. Furthermore, we focus on the trend change of the YOY growth rate as well as the difference of post intervention trend change of the YOY growth rate between the treated and the control group in multiple group ITSA, in order to estimate the intervention effect after implementation to the counterfactuals.

Multiple group ITSA

We extended a single ITSA to a multiple group ITSA, including the control group. We compared the interruption effect of hospital visits from AURIs and other diseases (high blood pressure, diabetes, cancer, and total ambulatory services). First, we defined the treatment group as those with AURIs because they have a similar transmission mechanism as that of COVID-19 and the patients might be affected by the widespread behavioural changes related to the pandemic. Second, we identified the control group as those with chronic diseases because their incidence has little association with the COVID-19 pandemic, but routine medical care is essential. Lastly, we added cancer outpatient visits as the control group because their appointments should not be deterred but might be deferred due to the fear of infection during hospital visits. In multiple group ITSA, we use the data from 2017 to 2020, since the trend and the difference in level before the intervention should be similar among treated and control groups.

Summary statistics

Table 1 presents the summary statistics for hospital visits by 65–84-year-olds from January to July in 2017-2020. Panel (a) shows the summary statistics for the period of January 1, 2020, to July 31, 2020, which represents 1) the number of patients per week 2)the year-over-year(YOY) growth in the number of patients per week for 65–84-year-olds at the onset of the COVID-19 pandemic crisis. Panel (b) presents ones between January 1 and July 31, 2017, 2018, and 2019. On one hand, the patients visit from total ambulatory services, and chronic diseases did not change much, while the number of patients with AURIs decreased during the COVID-19 pandemic period by 18.7% (with a standard deviation of 0.313) between the same week in 2019 and 2020. On the other hand, the number of patients from most of diseases increased during 2017-2019.

Table 1. Summary statistics

Diseases		1. January 1 st -July 31 st , 2020		1. January 1 st -July 31 st (2017, 2018, 2019)	
		Mean	Standard Dev	Mean	Standard Dev
Total	Number of patients per wk	5,128,322	1,103,284	5,201,306	1,010,169
	Change in the number of patients per wk	0.031	0.278	0.05	0.313
High blood pressure	Number of patients per wk	513,163	22,902	542,579	40,086
	Change in the number of patients per wk	-0.029	0.156	-0.007	0.108
Diabetes	Number of patients per wk	767,402	34,972	718,213	59,682
	Change in the number of patients per wk	0.033	0.164	0.054	0.116
Cancer	Number of patients per wk	75,990	6,133	54,665	10,238
	Change in the number of patients per wk	0.178	0.24	0.221	0.191
AURIs	Number of patients per wk	111,645	54,308	135,613	38,837
	Change in the number of patients per wk	-0.187	0.313	0.03	0.158

Note: This table presents the summary statistics for hospital visits for ambulatory services by 65–84-year-olds. Panel(a) covers the period between January 1st and July 31st in 2020 while panel (b) the same period of panel (a) in year 2017, 2018, and 2019. Mean represents the average number of weekly patients from each disease. The change in the volume of patients is calculated as the difference between the same week from the previous year (i.e., (week 6(2020)-week6(2019))/week6(2019)). The number of patients only include ones taking ambulatory services.

Results

Single ITSA

Fig. 1 shows the effect of COVID-19 pandemic on older people's hospital visits for total ambulatory services (A), high blood pressure (B), cancer (C), and AURIs (D). In contrast to the healthcare utilisation due to AURIs, in which AURI cases decreased compared to that in the previous year, other healthcare utilisation among the 65–84-year-olds did not change much.

Table 2 shows the results of a single ITSA with AURIs and other diseases. The level and trend change of the YOY growth rate after the first intervention have negative values and a statistically significant difference only in the AURIs, while visits for chronic diseases tended to be negatively associated with the intervention but without any statistical significance. Once the interruption starts, the patient visits due to AURIs drop by 75% (with p value<0.05), moreover the post-interruption trend shows an ongoing downward slope by 20.4 % (with p value<0.01). The second interruption event was set when mandated social distancing measures were relaxed, for example, after school opening. The post-interruption trend reverses in cases of AURIs by 7.8% (with p value<0.001), although the healthcare utilisation for other diseases had little change from that of the previous year. This indicates that relaxing the social distancing had an increasing effect on hospital visits for patients diagnosed with AURIs, while hospital visits for patients diagnosed with chronic diseases were not affected.

Table 2. Single Group ITSA

		AURIs	Total	High blood pressure	Diabetes	Cancer
Intercept	Coefficients	0.056	0.074	-0.164	-0.116	0.028
	95% CI	-0.162,0.275	-0.102,0.250	-0.491,0.163	-0.460,0.228	-0.448,0.504
	<i>P-value</i>	0.599	0.396	0.310	0.492	0.903
Trend before intervention	Coefficients	0.149	0.052	0.123	0.131	0.196
	95% CI	0.011,0.287	-0.034,0.139	-0.063,0.309	-0.063,0.326	-0.060,0.452
	<i>P-value</i>	0.036	0.227	0.185	0.176	0.127
Level change after 1 st intervention (week 6)	Coefficients	-0.759	-0.598	-0.506	-0.543	-0.957
	95% CI	-1.339,-0.178	-1.007,-0.190	-1.259,0.247	-1.330,0.243	-1.945,0.031
	<i>P-value</i>	0.013	0.006	0.178	0.167	0.057
Trend change after 1 st intervention (week 6)	Coefficients	-0.204	-0.017	-0.125	-0.133	-0.191
	95% CI	-0.341,-0.067	-0.125,0.091	-0.309,0.060	-0.325,0.060	-0.449,0.067
	<i>P-value</i>	0.005	0.751	0.175	0.167	0.140
Level change after 2 nd intervention (week 17)	Coefficients	0.070	-0.078	0.043	0.058	0.080
	95% CI	-0.029,0.168	-0.641,0.486	-0.035,0.122	-0.028,0.144	-0.047,0.206
	<i>P-value</i>	0.156	0.779	0.265	0.175	0.205
Trend change after 2 nd intervention (week 17)	Coefficients	0.078	-0.032	0.000	-0.000	-0.008
	95% CI	0.064,0.092	-0.107,0.043	-0.008,0.009	-0.010,0.009	-0.020,0.004
	<i>P-value</i>	0.0001	0.392	0.980	0.918	0.161

Note: This table presents the results of single interrupted time series analyses between January 2020 and July 2020. The defendant variable is the change in the volume of patients per week.

Multiple group ITSA

We use multiple group ITSA to assess the impact of COVID-19 pandemic and social distancing in reducing healthcare utilization for the elderly, using a multiple-group design. We compare patients from AURI's diagnosis with those of the other diseases. Fig. 2. presents the intervention effect for AURIs as the treatment group and that for other diseases as the control group. First, the upper panel shows the results of multiple group ITSA as AURIs for the treatment group versus total outpatients as the control group. Next, the lower presents ones as AURIs for the treated versus chronic diseases as the controlled. Figure 2. This represents the multiple groups interrupted time series analysis with two interventions. The treated group is AURIs while total outpatients and chronic diseases (high blood pressure as well as diabetes) are identified as control group. The outcome measure is the YOY growth rate for the number of patients from each disease per week between January-July, 2017 and 2020. The first intervention is week 6, 2020 and the second one week 17, 2020.

Table 3 presents the multiple group ITSA results for the two intervention periods. For healthcare utilisation, AURIs cases are considered as the treatment group and cases with other diseases are considered as the control group.

Table 3. Multiple group ITSA

Treated : AURI		Total	High blood pressure	Diabetes	Cancer
Intercept	Coefficients	0.004	-0.002	0.051	0.200
	95% CI	-0.105,0.113	-0.085,0.082	-0.040,0.142	0.035,0.364
	<i>P-value</i>	0.944	0.972	0.270	0.017
Trend before the 1 st intervention (week 6)	Coefficients	0.000	0.000	0.000	0.001
	95% CI	-0.001,0.002	-0.001,0.002	-0.001,0.002	-0.001,0.004
	<i>P-value</i>	0.652	0.630	0.473	0.180
Level change after the 1 st intervention (week 6)	Coefficients	-0.256	-0.075	-0.095	-0.314
	95% CI	-0.556,0.044	-0.172,0.022	-0.202,0.013	-0.471,-0.157
	<i>P-value</i>	0.094	0.128	0.086	<0.0001
Trend change after 1 st intervention (week 6)	Coefficients	0.032	-0.004	-0.005	0.006
	95% CI	-0.040,0.103	-0.012,0.003	-0.013,0.004	-0.008,0.020
	<i>P-value</i>	0.383	0.231	0.297	0.392
The difference in level before the 1 st intervention (week6)	Coefficients	0.023	0.028	-0.024	-0.173
	95% CI	-0.128,0.173	-0.105,0.161	-0.162,0.113	-0.368,0.021
	<i>P-value</i>	0.768	0.680	0.726	0.080
The difference in trend before the 1 st intervention (week6)	Coefficients	0.000	0.000	0.000	-0.001
	95% CI	-0.002,0.003	-0.002,0.002	-0.002,0.002	-0.003,0.002
	<i>P-value</i>	0.832	0.758	0.905	0.540
The difference in level after the 1 st intervention (week6)	Coefficients	0.163	-0.018	0.001	0.221
	95% CI	-0.162,0.487	-0.176,0.140	-0.164,0.167	0.020,0.422
	<i>P-value</i>	0.325	0.822	0.988	0.031
The difference in trend after the 1 st intervention (week6)	Coefficients	-0.090	-0.053	-0.053	-0.064
	95% CI	-0.163,-0.016	-0.071,-0.036	-0.071,-0.036	-0.085,-0.043
	<i>P-value</i>	0.017	<0.0001	<0.0001	<0.0001
Level change after the 2 nd intervention (week 17)	Coefficients	-0.066	0.053	0.069	0.070
	95% CI	-0.601,0.470	-0.020,0.126	-0.012,0.149	-0.045,0.185
	<i>P-value</i>	0.810	0.157	0.096	0.231
Trend change after the 2nd intervention (week 17)	Coefficients	-0.029	0.002	0.002	-0.011

	95% CI	-0.107,0.049	-0.005,0.010	-0.007,0.011	-0.024,0.003
	<i>P-value</i>	0.468	0.530	0.638	0.122
The difference in level after the 2 nd intervention (week 17)	Coefficients	0.144	0.026	0.010	0.009
	95% CI	-0.400,0.688	-0.097,0.148	-0.118,0.137	-0.143,0.160
	<i>P-value</i>	0.603	0.682	0.879	0.911
The difference in trend after the 2 nd intervention (week 17)	Coefficients	0.109	0.077	0.078	0.091
	95% CI	0.029,0.188	0.060,0.095	0.060,0.095	0.070,0.111
	<i>P-value</i>	0.008	<0.0001	<0.0001	<0.0001

Note: This table presents the results of multiple-group interrupted time series analyses between January – July from 2017-2020. The treated group is AURIs, while control groups include total ambulatory services, chronic diseases, and cancer (only including patients taking ambulatory services)

As shown in Table 3, the initial mean level difference of the YOY growth rate between AURIs and both chronic diseases is not statistically significant (*p value* =0.966, CI=[-0.119,0.124]). Moreover, the difference in the mean baseline slope is not distinctive either (*p value* =0.758, CI=[-0.002,0.002]). Hence, chronic diseases are comparable with AURIs on baseline level and trend before the intervention. There is no statistically significant treatment effect of the first intervention of week 6, whereas there is a statistically significant decline in the post trend compared with that of chronic diseases groups of 5.3%(with *p value* <0.001). Next, as the social distancing measures were lifted at the second intervention of week 17, the healthcare utilisation for AURIs turns upwards by 7.8% (with *p value* <0.001) compared with hospital visits from chronic diseases.

Discussion

Main finding of this study

From the start of the COVID-19 pandemic to the recovery period in the first half of 2020 in Korea, there was no significant change in the outpatient utilisation of medical facilities for high blood pressure, diabetes, or cancer among elderly people, while the outpatient visits for AURIs noticeably decreased. Our findings suggest that COVID-19 pandemic have not kept elderly people from accessing to essential medical services in Korea. These encouraging results may be due in part to the characteristics of Korea's appropriately mixed social distancing policies, i.e. the physical distance between people is voluntarily maintained, but formal control over movement is minimised at the same time, the appropriate supply of hospital services provided to non-COVID-19 patients. Since January 20, 2020, when Korea's first known case of COVID-19 was identified, the government has educated the public using a variety of media platforms on the importance of personal hygiene, such as wearing masks and handwashing, and there is widespread compliance with the recommended measures. The public healthcare system used a test-trace-treat (or isolate) strategy appropriately mixed with social distancing policies^[1]. Hospitals provided the logistics for isolation and intensive care treatment for COVID-19 patients and medical care for non-COVID-19 patients at the same time. COVID-19 patients were quarantined in medical facilities designated by the government while receiving medical treatment. Non-COVID-19 patients used hospital care without disruption at regular medical institutions where infection prevention policies were applied. Hospitals adopted preventive procedures and adjusted the physical environments to minimise the risks of COVID-19 transmission within the healthcare setting, in accordance with the guidelines^[2] jointly announced by the government and the Society for Infection Control^[3]. The public was informed of the National Relief Hospital^[4], appointed to ensure that the infection control measures were strictly kept, helping to relieve the anxiety of COVID-19 transmission in the hospital. In addition, temporary telehealth consultations were allowed, as well as proxy prescriptions, and dedicated respiratory clinics were endorsed for non-COVID-19 related health care utilisation²⁶. Our findings support a well-organized medical provision system can help patients use medical care even in pandemic situations³³.

What is already known on this topic

A reduction in the outpatient utilisation of medical facilities for AURIs is consistent with the results of previous studies^(34,35,36). First, restriction of medical resources due to sudden patient concentration or blockade of medical institutions affects the decline in the use of all diseases^(1,3). Second, the incidence of respiratory infections could be reduced significantly through improved personal hygiene management and social distancing measures including refraining from going out, closing schools, and working from home⁽³⁷⁻³⁹⁾. Immediately after the first COVID-19 outbreak, the Korean government strongly urged people to practice personal protective measures, and people agreed to adhere to the hygiene guidelines. People voluntarily abstained from going out due to concerns about infection even before the implementation of the national social distancing measures, confirmed by the reduced public transport use and traffic volume at that time in Korea^{40, 41}. Third, people may have avoided hospital visits, despite symptoms resulting from AURIs and other diseases, owing to the fear of COVID-19 infection⁴².

What this study adds

In Korea, the overall number of visits associated with high blood pressure, diabetes, and cancer in the elderly population was similar to that in the past even when the uncertainty and fear of infection were greatest. These results are contrasting to previous studies showing that healthcare utilisation related to these diseases decreased during COVID-19 because, in many countries, the use of essential medical services also decreased due to deteriorated functioning of medical institutions^(5, 16,17). However, the results of previous studies that the healthcare utilisation gradually recovered from patients with the high blood pressure and diabetes after a strong decrease in the initial stage are supported^{1,3}.

Limitations of this study

There are some limitations to interpreting the present study results. First, the observation period of the study was in the early stage of the COVID-19 pandemic in Korea. This was a time when the threat of infectious disease transmission was very high due to the fear of COVID-19 and the uncertain policy response. Due to the surge of COVID-19 infection among the religion group in Daegu and Gyeongbuk area, there may be some limitations to interpreting nationwide medical utilisation. In the future, it will be necessary to analyse the difference in medical visits between regions for a more accurate interpretation. Second, in this study, representative chronic and acute diseases necessitating frequent outpatient visits were selected. To determine changes in healthcare utilization, the more specific level of medical treatment data should be selected. However, to comprehensively interpret the impact on the Korean medical system during the COVID-19 pandemic, additional analysis on hospitalisation, emergency, and severe medical care will be required. Lastly, the estimate of effect size in interrupted time series analyses is dependent on the intervention timing. We deliberately choose the 1st intervention date after the week of Lunar new year holiday passed, which might affect the hospital visits, but before the official social distancing policy enforced. There were four weeks delays in putting mandated social distancing measures after the first COVID-19 case.

[1][http://ncov.mohw.go.kr/socdisBoardView.do?](http://ncov.mohw.go.kr/socdisBoardView.do?brdId=6&brdGubun=1&dataGubun=&ncvContSeq=&contSeq=&board_id=&gubun)

[brdId=6&brdGubun=1&dataGubun=&ncvContSeq=&contSeq=&board_id=&gubun](http://ncov.mohw.go.kr/socdisBoardView.do?brdId=6&brdGubun=1&dataGubun=&ncvContSeq=&contSeq=&board_id=&gubun) (Ministry of Health and Welfare, Korea Center for Disease Control and Prevention (2020.2))

[2] Central Defense Countermeasure Headquarters. (2020.4.) Prevention and management of coronavirus infection-19 infection in medical institutions (for nursing hospitals)

[3] Korea Centers for Disease Control and Prevention, Korean Society for Medical Infection Control, Korean Society for Infection Control and Nurses, Korean Society for Infectious Diseases (2020.2.) Preventing and managing new coronavirus infections (for clinic-level medical institutions)

[4] Ministry of Health and Welfare press release (February 24, 2020). Operation of 'National Relief Hospital' that is safe from COVID-19 infection.

Conclusions

We analysed the year-over-year growth in the number of patients for AURIs and chronic among elderly people to investigate the healthcare utilisation in Korea during the COVID-19 pandemic. The patients associated with AURIs showed a large decreases, while visits for chronic diseases were similar to pre-COVID-19 trends. Our findings imply that the Korean public health authority effectively managed the medical system to accommodate non-COVID-19 medical care along with a strong COVID-19 containment policy in the healthcare settings, and its dual strategy works to maintain the healthcare system even in the middle of an infectious disease crisis.

Declarations

Authors' contribution

KP and JB were responsible for the idea and design of this study. KP defined the analytical strategy, performed empirical analysis, and drafted the manuscript. KP, JB, and YY critically interpreted results with relevant intellectual input, revised the manuscript, and approved the final manuscript. HC was responsible for the data. KP is the first author. KP and JB had primary responsibility for the final content and are joint corresponding authors.

Ethical approval

All procedures of the present study were carried out in accordance with the principle for human investigations. Formal ethics approval was waived by the ethical review board of National Health Insurance Service Korea.

Data availability statement

The data used in this study were provided by National Health Insurance Service Korea. Data will be shared on request to the corresponding author with permission of the National Health Insurance Service Korea.

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Conflict of interest

The authors declare that they have no potential conflict of interest in the publication of this research output: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous three years; and no other relationships or activities that could appear to have influenced the submitted work.

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Figures

Figure 1

Single ITSA Note: Figure 1 represents the single interrupted time series analysis with two interventions. The outcome measure is the YOY growth rate for the number of patients from each disease per week between January-July, 2019 and 2020. The first intervention is week 6, 2020 and the second one week 17, 2020.

Figure 2

Multiple-group ITSA Note: Figure 2 represents the multiple groups interrupted time series analysis with two interventions. The treated group is AURIs while total outpatients and chronic diseases (high blood pressure as well as diabetes) are identified as control group. The outcome measure is the YOY growth rate for the number of patients from each disease per week between January-July, 2017 and 2020. Black dot is the YOY of treated group while white dot as that of control group. The black line presents the trend of the YOY of treated group before and after the interventions.