

Longitudinal and Epidemiological Study for Nationally Insured Patients of Private Dental Clinic in Korea

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Received April 29, 2014

Revised May 14, 2014

Accepted June 2, 2014

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Purpose: This study want to draw conclusion based on data taken from national health insurance and determined the distribution and direction of patients treated at private clinics.

Methods: The author's research spanned and compared the nationally insured patients by sexes, diagnoses, age groups and cases per year (2005, 2009, and 2013). Subjects were 3,536 patients of a private clinic in Seoul that were covered under national insurance.

Results: There was no disparity across sexes nor cases, but both were on the decline. The most common dental conditions were pulpitis and dental caries at 38.4% and 16.4%, respectively. Both have decreased. Despite a drop in overall patients, the percentage of patients under 10 years old jumped substantially. Of overall age groups, teens were most prevalent at 33.5%, second and third being those in their forties and fifties (14.2% and 12.0%, respectively).

Conclusions: The major illnesses that plague patients are pulpitis, dental caries, eruption disorder, gingivitis and periodontitis: the wane of pulpitis cases (a considerable percentage) and the actual numbers of patients has contributed to the general decrease in cases.

Key Words: Epidemiologic studies; Longitudinal studies; Nationally insured patients

INTRODUCTION

Standards of dental hygiene have steadily increased from when dentistry was first introduced in Korea in 1893, with talented dentists being produced with every generation. Korea's medical insurance laws were implemented in 1963, and health care was made available to every citizen from July 1989. In addition, Korea separated the duty of judgment from the national insurance agencies and installed an independent, separate branch—the Health Insurance Review and Assessment Service (HIRAS), overseeing the payout fees and appropriate payments for medical treatment.¹⁾ The medical insurance system is also a subdivision of the oral health sector pertaining to multiple treatments and deals with payment plans. It affects the production, distribution and use of treatment and medication both directly and indirectly, with the fallout reaching oral health standards and satisfaction of customers.

A drastic change in diet heralded by cultural and economic changes have shown increased cases of dental caries, which is presenting a major problem for the National Health Service. Dental caries, periodontal disease and malocclusion are often nominated as the three major oral diseases, with the leading cause of teeth loss being periodontal disease and dental caries.²⁾

Won et al.'s research³⁾ states that Korean dental health standards are dropping despite the increase in overall income and standards of living. This is backed up by various studies: Kim et al.⁴⁾ reported 2.3 caries on permanent teeth (decayed, missing, and filled teeth [DMFT] index, mean number of decayed or missing or filled permanent teeth) from a study of 12-year-olds in 1979 and Kim et al. reported 3.03 caries in 1991.⁵⁾ The National Oral Health Bureau confirmed that the number of caries was increasing with a 3.11 in a 1995 report,⁶⁾ and a fourth report from the Dental Research Institute reported 3.3 caries in 2000.⁷⁾ Research

confirms that Korean dental health is worsening—slowly but steadily.

In a continuation of the above experiments, we have drawn conclusions based on data taken from national health insurance and determined the distribution and direction of patients treated at private clinics. The duration was 9 years with a 4-year interval between each.

MATERIALS AND METHODS

1. Subjects

This study was taken from a private clinic in Seoul with a duration of 3 years (2005, 2009, and 2013) and a 4-year-interval between each. Our subjects were patients who we filed for health insurance: we received 9,504 cases from 3,536 overall patients (Table 1). Classification of these diseases followed the Korean Standard Classification of Diseases issued from the Statistics Korea.⁸⁾

2. Methods

Common names for diseases are based on clinical and radiological findings as well as various records of demands for health insurance. The 9 main diseases were selected, and diagnoses with under 10 cases were included in the miscellany (others). The order is presented in annual cases, number of patients, comparison between genders, comparison between diseases, and comparison between age groups as

Table 1. Gender-based comparison of annual cases and patients and the results of χ^2 test

Gender & total	Year			Total
	2005	2009	2013	
Gender				
Male				
Frequency (n)	1,843	1,644	1,368	4,855
% of year	19.4	17.3	14.4	51.1
Adjusted residual	-2.5	1.9	0.8	
Female				
Frequency (n)	1,882	1,491	1,276	4,649
% of year	19.8	15.7	13.4	48.9
Adjusted residual	2.5	-1.9	-0.8	
Total				
Frequency (n)	3,725	3,135	2,644	9,504
% of year	39.2	33.0	27.8	100.0
Number of treatment visits	3,725	3,135	2,644	9,504
Number of patients	1,293	1,220	1,023	3,536

follows: 1) gender-based comparison of annual cases and patients, 2) 3-year comparison of gender per diagnoses (number of treatment visits), 3) 3-year comparison of gender per age groups (number of patients), and 4) 3-year comparison of diagnoses per age groups (number of treatment visits).

3. Statistical Analysis

The author used PASW Statistics 18.0 (IBM Co., Armonk, NY, USA) to analyze the statistical data, and the strategies included chi-squared test (χ^2 test) and one way/two way ANOVA (statistical significance level, $p < 0.05$).

RESULTS

1. Gender-based Comparison of Annual Cases and Patients

The number of cases through 2005, 2009, and 2013 dropped from 3,725 to 3,135 to 2,644, respectively. Males tended to compromise slightly more than females, with the exception of 2005 (Table 1).

2. Three-year Comparison of Gender per Diagnoses (Number of Treatment Visits)

Pulpitis (38.4%) had the highest percentage of diagnoses, followed by dental caries (16.4%). However, pulpitis has shown a radical drop during 9 years, with incidence of caries decreasing slightly. Eruption disorder increased slightly and is now static: in general, the prevalence of oral medicine disease grew marginally (Table 2) with gingivitis and periodontitis, tooth abrasions and fractures all in this category. Males were diagnosed more frequently than females (51.1% and 48.9% in Table 1) but females were diagnosed more frequently than males in 2005 (Table 2). Diagnoses of pulpitis in males were more common in 2013 with tooth abrasions in 2005 and root rest more frequent in 2009 respectively. Caries in females were higher in all years, with eruption disorder in 2005. There was no significant difference between genders beyond these listed.

3. Three-year Comparison of Gender per Age Groups (Actual Number of Patients)

Despite the steady decrease in patients from 2005 to 2013 (1,293 to 1,023 patients), there has been an increase in patients under 10 years old but drastic decreases in patients in

Table 2. Three-year comparison of gender per diagnoses and the results of χ^2 test

Diagnosis	2005			2009			2013			Total
	Male	Female	Total	Male	Female	Total	Male	Female	Total	
Pulpitis										
Frequency (n)	880	879	1,759	625	524	1,149	418	327	745	3,653
% of total	23.6	23.6	47.2	19.9	16.7	36.7	15.8	12.4	28.2	38.4
Adjusted residual	0.6	-0.6		1.7	-1.7		2.8	-2.8		
Caries										
Frequency (n)	266	332	598	240	292	532	195	232	427	1,557
% of total	7.1	8.9	16.1	7.7	9.3	17.0	7.4	8.8	16.1	16.4
Adjusted residual	-2.7	2.7		-3.7	3.7		-2.7	2.7		
Gingivitis and periodontitis										
Frequency (n)	209	188	397	253	219	472	227	237	464	1,333
% of total	5.6	5.0	10.7	8.1	7.0	15.1	8.6	9.0	17.5	14.0
Adjusted residual	1.3	-1.3		0.5	-0.5		-1.3	1.3		
Eruption disorder										
Frequency (n)	249	299	548	294	275	569	221	207	428	1,545
% of total	6.7	8.0	14.7	9.4	8.8	18.1	8.4	7.8	16.2	16.3
Adjusted residual	-2.0	2.0		-0.4	0.4		0.0	0.0		
Root rest										
Frequency (n)	78	65	143	98	45	143	36	20	56	342
% of total	2.1	1.7	3.8	3.1	1.4	4.6	1.4	0.8	2.1	3.6
Adjusted residual	1.2	-1.2		3.9	-3.9		1.9	-1.9		
Ill fitting prosthetics										
Frequency (n)	33	27	60	27	15	42	12	15	27	129
% of total	0.9	0.7	1.6	0.9	0.5	1.3	0.5	0.6	1.0	1.4
Adjusted residual	0.9	-0.9		1.5	-1.5		-0.8	0.8		
Tooth abrasion										
Frequency (n)	44	18	62	23	32	55	45	49	94	211
% of total	1.2	0.5	1.7	0.7	1.0	1.8	1.7	1.9	3.6	2.2
Adjusted residual	3.4	-3.4		-1.6	1.6		-0.8	0.8		
Tooth fractures										
Frequency (n)	18	15	33	22	17	39	33	28	61	133
% of total	0.5	0.4	0.9	0.7	0.5	1.2	1.2	1.1	2.3	1.4
Adjusted residual	0.6	-0.6		0.5	-0.5		0.4	-0.4		
Oral medicine disease										
Frequency (n)	13	16	29	18	25	43	32	38	70	142
% of total	0.3	0.4	0.8	0.6	0.8	1.4	1.2	1.4	2.6	1.5
Adjusted residual	-0.5	0.5		-1.4	1.4		-1.0	1.0		
Others										
Frequency (n)	53	43	96	44	47	91	149	123	272	459
% of total	1.4	1.2	2.6	1.4	1.5	2.9	5.6	4.7	10.3	4.8
Adjusted residual	1.1	-1.1		-0.8	0.8		1.1	-1.1		
Total										
Frequency (n)	1,843	1,882	3,725	1,644	1,491	3,135	1,368	1,276	2,644	9,504
% of total	49.5	50.5	100.0	52.4	47.6	100.0	51.7	48.3	100.0	100.0

their teens, twenties (2013) and forties. Most patients were teenagers (33.5%) followed by those in their forties (14.2%) and fifties (12.0%). Overall there were slightly more female patients than males (50.3% versus 49.7%) and no significant variations in age between them, with the exception of more female patients in their thirties and more male patients in their fifties (Table 3).

4. Three-year Comparison of Diagnoses per Age Groups (Number of Treatment Visits)

Children under 10 years old had a substantial swell in dental caries, oral medicine diseases, others and a slighter increase in eruption disorder. Adolescent cases decreased in general, but remained the most prominent figure (30.3%) within the age brackets. Most common diagnoses included

Table 3. Three-year comparison of gender per age groups and the results of χ^2 test

Age (y)	Gender		Total	Year			Total
	Male	Female		2005	2009	2013	
≤9							
Frequency (n)	122	138	260	23	54	183	260
% of total	3.5	3.9	7.4	0.7	1.5	5.2	7.4
Adjusted residual	-0.9	0.9		-9.6	-4.8	15.3	
10-19							
Frequency (n)	607	576	1,183	457	430	296	1,183
% of total	17.2	16.3	33.5	12.9	12.2	8.4	33.5
Adjusted residual	1.3	-1.3		1.8	1.6	-3.6	
20-29							
Frequency (n)	148	177	325	130	124	71	325
% of total	4.2	5.0	9.2	3.7	3.5	2.0	9.2
Adjusted residual	-1.6	1.6		1.3	1.5	-3.0	
30-39							
Frequency (n)	132	219	351	142	123	86	351
% of total	3.7	6.2	9.9	4.0	3.5	2.4	9.9
Adjusted residual	-4.8	4.8		1.6	0.2	-1.9	
40-49							
Frequency (n)	262	239	501	191	185	125	501
% of total	7.4	6.8	14.2	5.4	5.2	3.5	14.2
Adjusted residual	1.2	-1.2		0.8	1.2	-2.1	
50-59							
Frequency (n)	242	183	425	153	144	128	425
% of total	6.8	5.2	12.0	4.3	4.1	3.6	12.0
Adjusted residual	3.2	-3.2		-0.3	-0.3	0.6	
60-69							
Frequency (n)	122	105	227	98	59	70	227
% of total	3.5	3.0	6.4	2.8	1.7	2.0	6.4
Adjusted residual	1.2	-1.2		2.1	-2.8	0.7	
70-79							
Frequency (n)	94	95	189	64	81	44	189
% of total	2.7	2.7	5.3	1.8	2.3	1.2	5.3
Adjusted residual	0.0	0.0		-0.8	2.5	-1.8	
≥80							
Frequency (n)	30	45	75	35	20	20	75
% of total	0.8	1.3	2.1	1.0	0.6	0.6	2.1
Adjusted residual	-1.7	1.7		1.8	-1.4	-0.4	
Total							
Frequency (n)	1,759	1,777	3,536	1,293	1,220	1,023	3,536
% of total	49.7	50.3	100.0	36.6	34.5	28.9	100.0

eruption disorder (15.1%), pulpitis (5.9%) and caries (4.8%) with an increase in eruption disorder. Diagnoses of adults in their twenties saw an increase in pulpitis and caries, while those in their thirties saw a drop in eruption disorder and an increase in pulpitis and caries, periodontitis, with root rest. Forties had a great increase in pulpitis and a general increase in periodontitis, with root rest, ill-fitting prosthetics, and tooth abrasion. Fifties had a great increase in pulpitis, with periodontitis, tooth abrasions and a general increase in root rest. Sixties had a great increase in pulpitis,

with periodontitis, and a general increase in tooth abrasion. Seventies had a general increase in pulpitis and periodontitis, with root rest and tooth abrasion. Eighties and above had an increase in pulpitis, root rest, tooth fractures, and oral medicine diseases. The overall number of pulpitis and caries gradually decreased, but a steep incline pertaining to children under 10 years old. Patients in their fifties and sixties were prone to gingivitis and periodontitis, and young children (under 10 years old) to general oral medicine disease throughout (Table 4).

Table 4. Three-year comparison of diagnoses per age groups and the results of χ^2 test

Age (y)	Diagnosis										Total
	Pulpitis	Caries	Periodontitis	Eruption disorder	Root rest	Ill fitting prosthetics	Tooth abrasion	Tooth fractures	Oral medicine disease	Others	
≤ 9											
Frequency (n)	98	127	20	88	0	2	0	5	30	59	429
% of diagnosis	1.0	1.3	0.2	0.9	0.0	0.0	0.0	0.1	0.3	0.6	4.5
Adjusted residual	-6.8	7.6	-5.7	2.4	-4.1	-1.6	-3.2	-0.4	9.6	8.8	
10-19											
Frequency (n)	556	458	125	1,435	13	44	0	8	31	208	2,878
% of diagnosis	5.9	4.8	1.3	15.1	0.1	0.5	0.0	0.1	0.3	2.2	30.3
Adjusted residual	-25.3	-0.8	-17.9	58.5	-10.9	1.0	-9.7	-6.1	-2.2	7.2	
20-29											
Frequency (n)	332	236	115	15	9	7	6	15	10	27	772
% of diagnosis	3.5	2.5	1.2	0.2	0.1	0.1	0.1	0.2	0.1	0.3	8.1
Adjusted residual	2.7	11.1	0.7	-11.2	-3.8	-1.1	-2.8	1.3	-0.5	-1.8	
30-39											
Frequency (n)	331	179	145	4	46	13	13	13	5	37	786
% of diagnosis	3.5	1.9	1.5	0.0	0.5	0.1	0.1	0.1	0.1	0.4	8.3
Adjusted residual	2.2	5.1	3.7	-12.5	3.5	0.8	-1.1	0.6	-2.1	-0.2	
40-49											
Frequency (n)	811	258	261	2	83	35	49	29	14	49	1,591
% of diagnosis	8.5	2.7	2.7	0.0	0.9	0.4	0.5	0.3	0.1	0.5	16.7
Adjusted residual	11.3	-0.2	3.0	-19.1	3.8	3.2	2.6	1.6	-2.2	-3.6	
50-59											
Frequency (n)	538	150	315	1	59	12	63	20	15	27	1,200
% of diagnosis	5.7	1.6	3.3	0.0	0.6	0.1	0.7	0.2	0.2	0.3	12.6
Adjusted residual	4.9	-3.9	13.0	-16.2	2.6	-1.1	7.6	0.8	-0.7	-4.5	
60-69											
Frequency (n)	494	74	183	0.0	43	11	38	14	11	15	883
% of diagnosis	5.2	0.8	1.9	0.0	0.5	0.1	0.4	0.1	0.1	0.2	9.3
Adjusted residual	11.2	-6.7	6.0	-13.7	2.1	-0.3	4.4	0.5	-0.6	-4.6	
70-79											
Frequency (n)	349	59	121	0	55	2	40	15	11	22	674
% of diagnosis	3.7	0.6	1.3	0.0	0.6	0.0	0.4	0.2	0.1	0.2	7.1
Adjusted residual	7.4	-5.6	3.0	-11.9	6.6	-2.5	6.8	1.9	0.3	-2.0	
≥ 80											
Frequency (n)	144	16	48	0	34	3	2	14	15	15	291
% of diagnosis	1.5	0.2	0.5	0.0	0.4	0.0	0.0	0.1	0.2	0.2	3.1
Adjusted residual	3.9	-5.1	1.2	-7.6	7.5	-0.5	-1.8	5.0	5.2	0.3	
Total											
Frequency (n)	3,653	1,557	1,333	1,545	342	129	211	133	142	459	9,504
% of diagnosis	38.4	16.4	14.0	16.3	3.6	1.4	2.2	1.4	1.5	4.8	100.0

DISCUSSION

The author has recorded information from the common names of diseases to fulfill demands for health insurance, which covers 2005, 2009, and 2013. It may be of assistance in predicting the course of action that needs to be taken for the proper care and treatment of dental patients of varying ages and reform policies if needed.

The number of cases and patients has fallen as well.

Pulpitis, which compromises the majority of dental problems that dentists oversee, has undergone a downturn in cases because of the emphasized importance of oral health. The importance of dental hygiene and public awareness—patients usually receiving treatment before symptoms deteriorate—has contributed to the dearth of pulpitis diagnoses and discontinuous cases. The overall number of patients have decreased, while the percentage of children under 10 years old has risen. Children teens are now the largest age

group of patients, with those in their forties and fifties in close pursuit. Residences near private clinics tend to house parents and children, which make up the bulk of their patients. The relative decline in patients and cases is because of the growing number of new clinics and the competition that arises from them.

The increase of children pulpitis under 10 years old occurred when apartments were renovated for the middle-class in lieu of the low-income families and sugary diets became more common. Private clinics were highly affected depending on where they were. The state renovations of 2009 effectively cut down on the older generation (70 years old and above) and invited children. In addition, the insured sealant act of December 2009 contributed to the rise of child patients and may have influenced future data. The number of healthy young adults dropped because of financial difficulties and problems with unemployment. The minimal increase of those in their fifties and sixties was probably due to the price drop of insured scaling. The changing trends of the world population, as females live longer than males on average, has factored into the increase of young males (teens) and females above 80 years old.

The percentage of Korea's population with decayed, missing, or filled permanent teeth (DMFT index) amounted to 61.6% in 2006 and steadily decreased to 60.5% and 57.3% in 2010 and 2012, respectively. There were more permanent teeth caries in females. The percentage of people with active dental caries on permanent teeth dropped from 23.7% to 12.15%, nearly half of what it was; males from 21.1% to 11.7% and females from 26.6% to 12.6%, from 2006 to 2012. The DMFT index steadily decreased 2.2 in 2006, 2.1 in 2010, and 1.8 in 2012.⁹⁾ This study showed that more females had permanent teeth caries than males. It contains the same information as previous KDA's report.⁹⁾

In addition, the number of patients who were treated gingival and periodontal disease have increased 25.3% from 2008 to 2012 (6.73 million to 8.43 million). In 2012, 49.66 million people who were covered by health insurance were treated for gingivitis and periodontitis.¹⁰⁾ In this study, there is only a minor difference between the total patients from 2009 to 2013—in fact the number has fallen, but if one considers that the patients at private clinics numbered 1,220 in 2009 and 1,023 in 2013—a 16% difference—there is little

palpable difference between them. Furthermore, this report is consistent with previous HIRA's result¹⁰⁾ sentence, as it state that the growth and distribution of gingivitis and periodontitis is roughly equal across genders, and there is no difference between them.

Reports from the 2014 HIRAS,¹¹⁾ the number of patients who were treated dental caries fell 5.8% (330 thousand) from 2009 to 2013, from 5.76 million to 5.43 million: –1.5% per year. One in ten had received treatment for caries. Of the people who received treatment for dental caries in the last five years, females compromised 52.8%–53.4% and males 46.6%–47.2%. In addition (in 2013) children under 10 years old were most susceptible to dental caries, followed by teenagers and young adults (20.5%, 14.5%, and 13.5%). Males under ten years old took 10.5% of the entire group: there were more males than females in accordance with the conclusions of this study.

According to the dental news,¹²⁾ HIRAS explained, “Increased awareness about oral health has contributed to far less caries of the general public. However, the widespread popularity of esthetic materials such as resin or glass ionomer (GI) cement and the greater availability of sealant has increased the costs of a trip to the dentist.” The rate of dental caries in patients more than seventy years old has a growth rate of 7.8% per year, contrasting with children and teenagers—a steady decrease of 3.5% per year (21.9 million in 2009 to 19 million in 2013), attributed to the low birth rates and aging population that have given rise to a changing social phenomena: and, of course, the shifting ratios. This study proves this theory by showing that fewer teenagers and twenties are coming to private clinics for their dental health. But, fewer elderly are coming to private clinics for their dental health. It proves a different result with Lee.¹²⁾

Park's dissertation¹³⁾ gives 18.9% for workers with dental caries: males and females in their twenties are most susceptible with 24.9% and 22.2%, respectively. The fact that periodontal disease tends to be more common than caries as people age seems to be the main reason—as with the fact that those in their twenties are the unlikeliest age bracket to visit clinics in the past year.

Females had more caries than males in all age groups: Finn's argument¹⁴⁾ states that females have earlier eruptions of their permanent teeth than males, and this exposure

to the elements induces deterioration more quickly. The Korean national oral health survey in 2003¹⁵⁾ shows that permanent teeth usually erupt from children six and above, and females have worse teeth than males because their teeth was exposed longer.

Yang's research¹⁶⁾ showed that patients who sought treatment for temporomandibular disorder (TMD), a typical oral disease was 0.15% of the population and had an upwards trend for three years: 99.8% were female, and their twenties were most susceptible, with the frequency decreasing as they aged. This result matches with previous epidemiologic research. Patients with a TMD diagnoses has a 0.14% in 2003, 0.16% in 2004, and 0.17% in 2005, but it is still quite low compared the 5%-6% reported from overseas¹⁷⁾: this can be attributed to public ignorance of TMD and the inability of dental organizations to be involved with its treatment.

Oral diseases have widespread causes by nature and tend to be chronic, deteriorating and irreversible; however, they can be prevented. Early detection and treatment is key to reducing financial costs, and patients should book checkups regularly. Several sociological and environmental reasons exist as to why dental visits are usually treatment-only; the most important is the payment system for "fee-for-service." Doctors receive payment for each individual practice, and patients of struggling dentists see them more often. The waning masses of patients contrast with the swelling tally of dental clinics, with the same result: more dentists with financial difficulties. In addition, dental hygiene ranks low on public awareness. This results in a higher number of patients that are careless with their oral health and a lot of dentists don't prevent for their patients properly.

The HIRAS documents the prevalence of each disease and estimates the need for dental service. The health insurance payment system should be changed for preventive practice and should be backed up with proper payment for management clinics.

This study is from a single clinic's documents. Its weaknesses is that it can no means be representative of the entirety of the private clinics in Korea and doesn't have the statistics of non-insured cases (for example, orthodontic treatments etc.). More research that supplement this information should be written and a constant wealth of

information sought henceforth.

This dissertation has targeted patients that are covered under insurance that attend private dental clinics in Seoul for treatment (with the timeline being 2005, 2009, and 2013) with epidemiological causes in mind and has received results as follows.

1. There was no difference in cases or numbers between males and females, and both decreased from 2005 to 2013.

2. Pulpitis and dental caries had the highest concentration within gender-based diagnoses, though both fell substantially: pulpitis dropped more than caries. In comparison, gingivitis and periodontitis, oral medicine diseases, tooth abrasions and tooth fractures all increased. Females have had more caries than males, and males have shown a greater concentration of pulpitis (2013) than females.

3. Despite the steady decrease in patients, there has been a sudden upsurge in younger patients (children under 10 years old). Of overall age groups, teens were most prevalent at 33.5%, second and third being those in their forties and fifties with young males (teens) and elderly females (80 years old above) at the increase.

4. With the exception of children under 10 years old, pulpitis and caries have decreased steadily. Gingivitis and periodontitis have continued to rise, with those in their fifties and sixties at the forefront. Oral medicine diseases are a lesser presence, but continue to rise—especially in children under 10 years old.

In conclusion, the major illnesses that plague patients are pulpitis, dental caries, eruption disorder, gingivitis and periodontitis: the wane of pulpitis cases (a considerable percentage) and the actual numbers of patients has contributed to the general decrease in cases.

CONFLICT OF INTEREST

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

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