COVID-19 Response and Experience in Seoul

Seoul Metropolitan Government

Citizens' Health Bureau

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Expanding the Organization of the Seoul Citizens' Health Bureau to Effectively Respond to COVID-19

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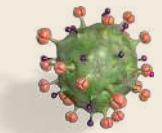


□ Advancing Background

(https://m.newspim.com/news/view/20221227000666)

○ The cumulative number of COVID-19 cases in Seoul is close to 5.6 million.

Reinfection rates continue to increase and about 15% are now the largest epidemic in history.

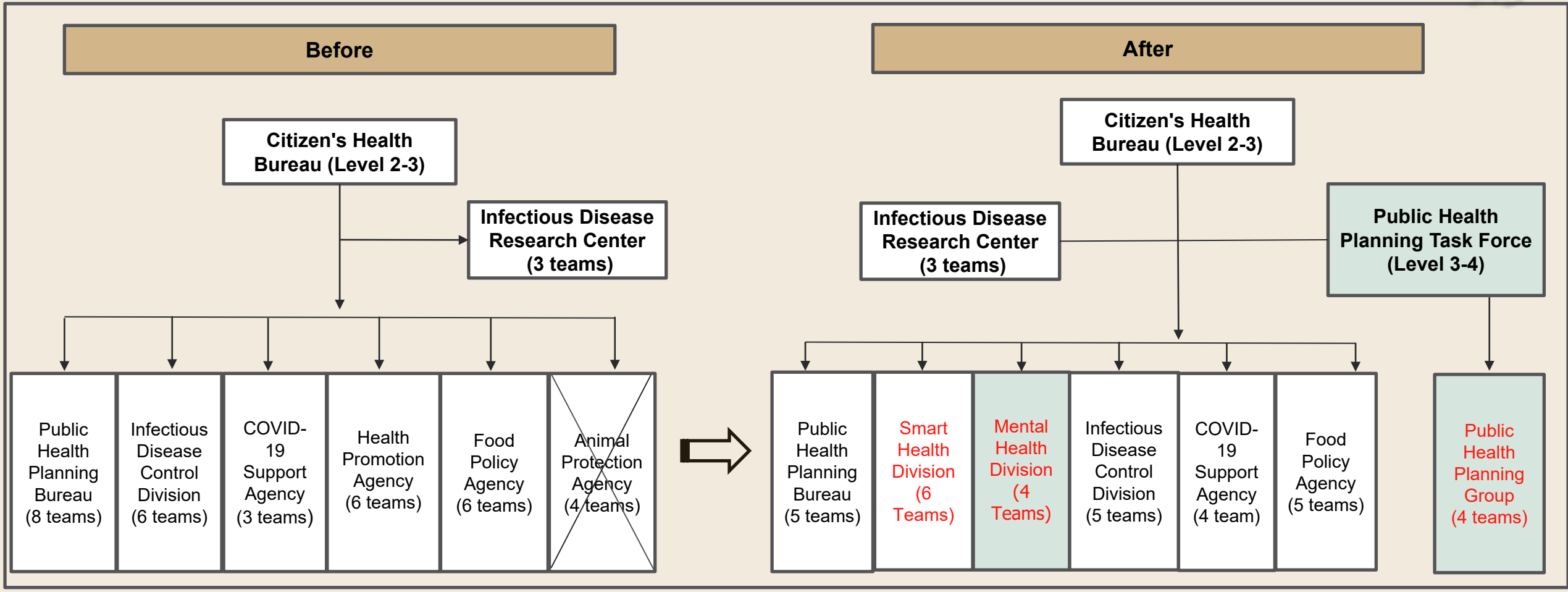
The cumulative death toll stands at 6,023 as of Dec. 28, 2022

➡ In order to effectively cope with similar situations after COVID-19, the Seoul Metropolitan government had to strengthen organizational restructuring in all medical fields

Expansion of Organization of the Seoul Citizen's Health Bureau

- **Citizens' Health Bureau: a key role in responding to COVID-19 in Seoul**
- **Reorganization of Citizen's Health Bureau by year**

(2021) 1 bureau, 6 divisions, 1 center, 34 teams
(2022) 1 bureau, 1 task force, 6 divisions, 1 center, 1 class, 36 teams



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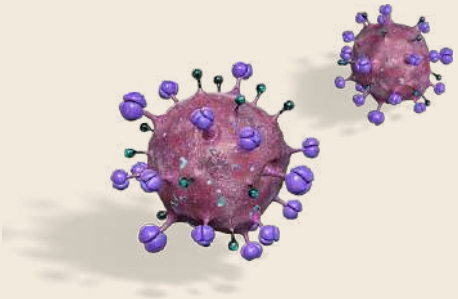
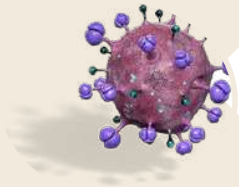


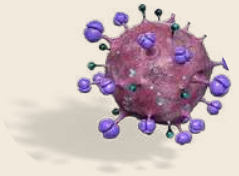
Evaluation of COVID-19 Situation in Seoul and Implementation of System Operation

Current Situation of COVID-19 in Seoul

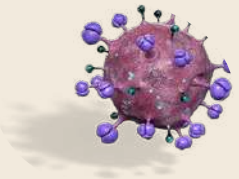
□ Outline



Background:
With the recent shortening of the occurrence cycle of infectious diseases, it is necessary to conduct infectious disease information analysis and risk assessment to deal with infectious diseases



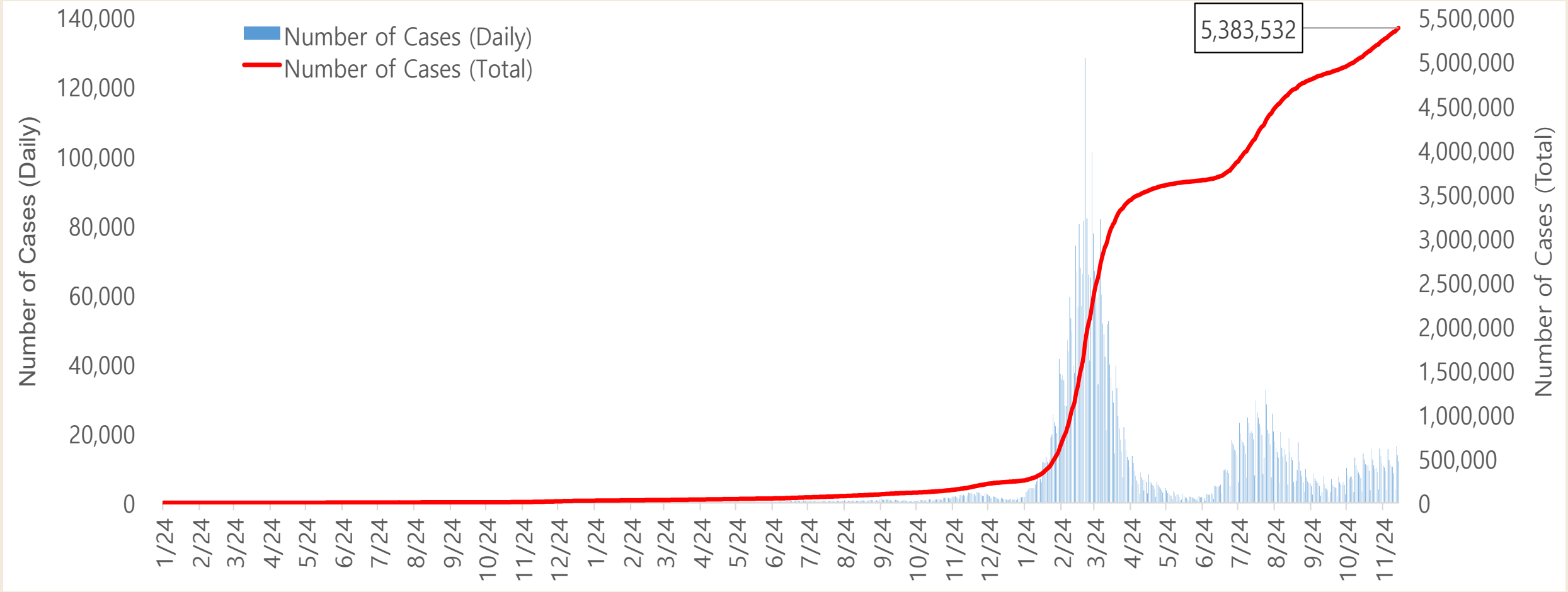
Objective:
To prevent the early spread of infectious diseases and provide infectious disease information to the public by analyzing infectious disease information



Expected results:
Through the analysis of infectious disease information and the construction of response system, we can establish countermeasures to prevent the spread of infectious diseases

Current Situation of COVID-19 in Seoul

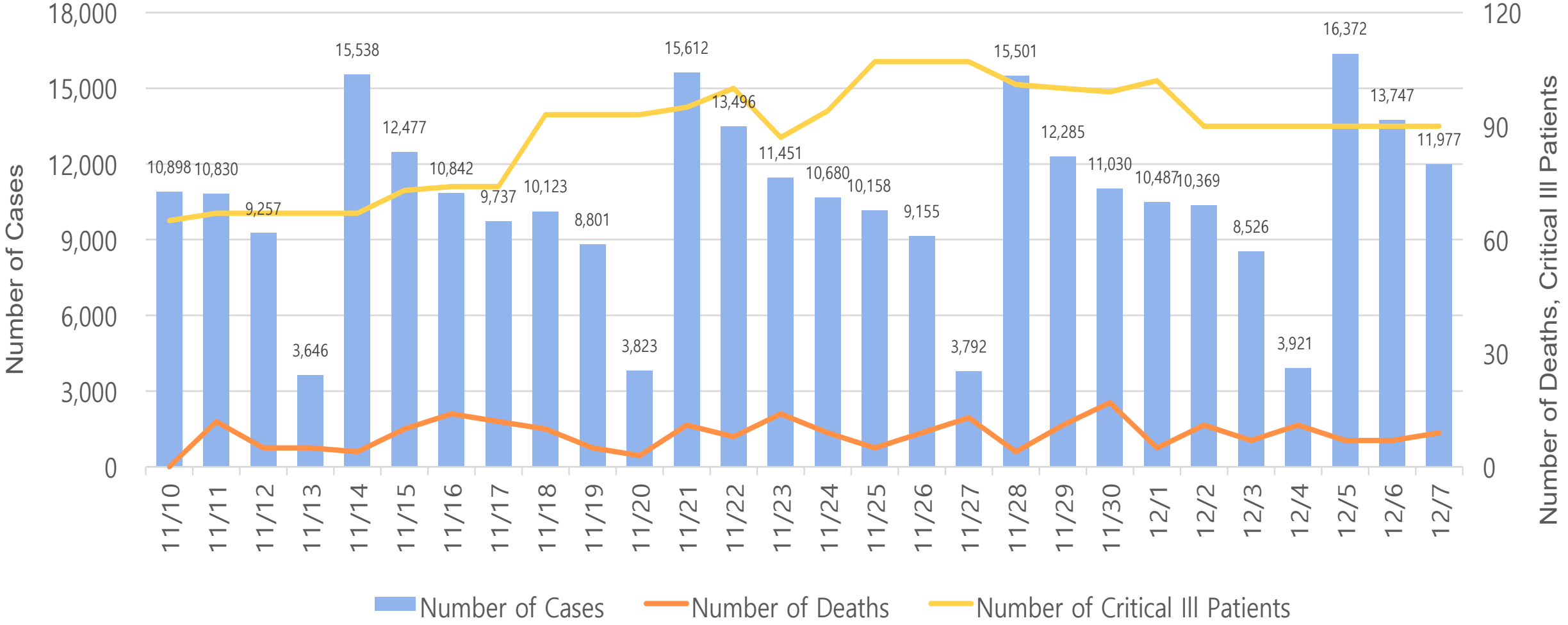
Cumulative status of COVID-19 confirmed cases (Dec. 12, 2022, 24:00)



Current Situation of COVID-19 in Seoul

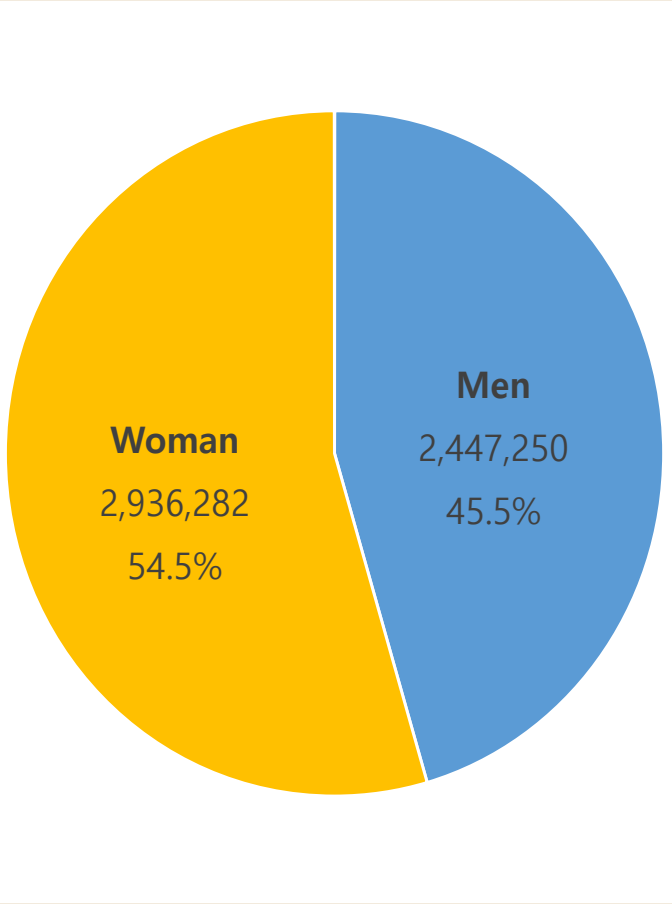
The main index trend of COVID-19 during the period when BA.5 was dominant

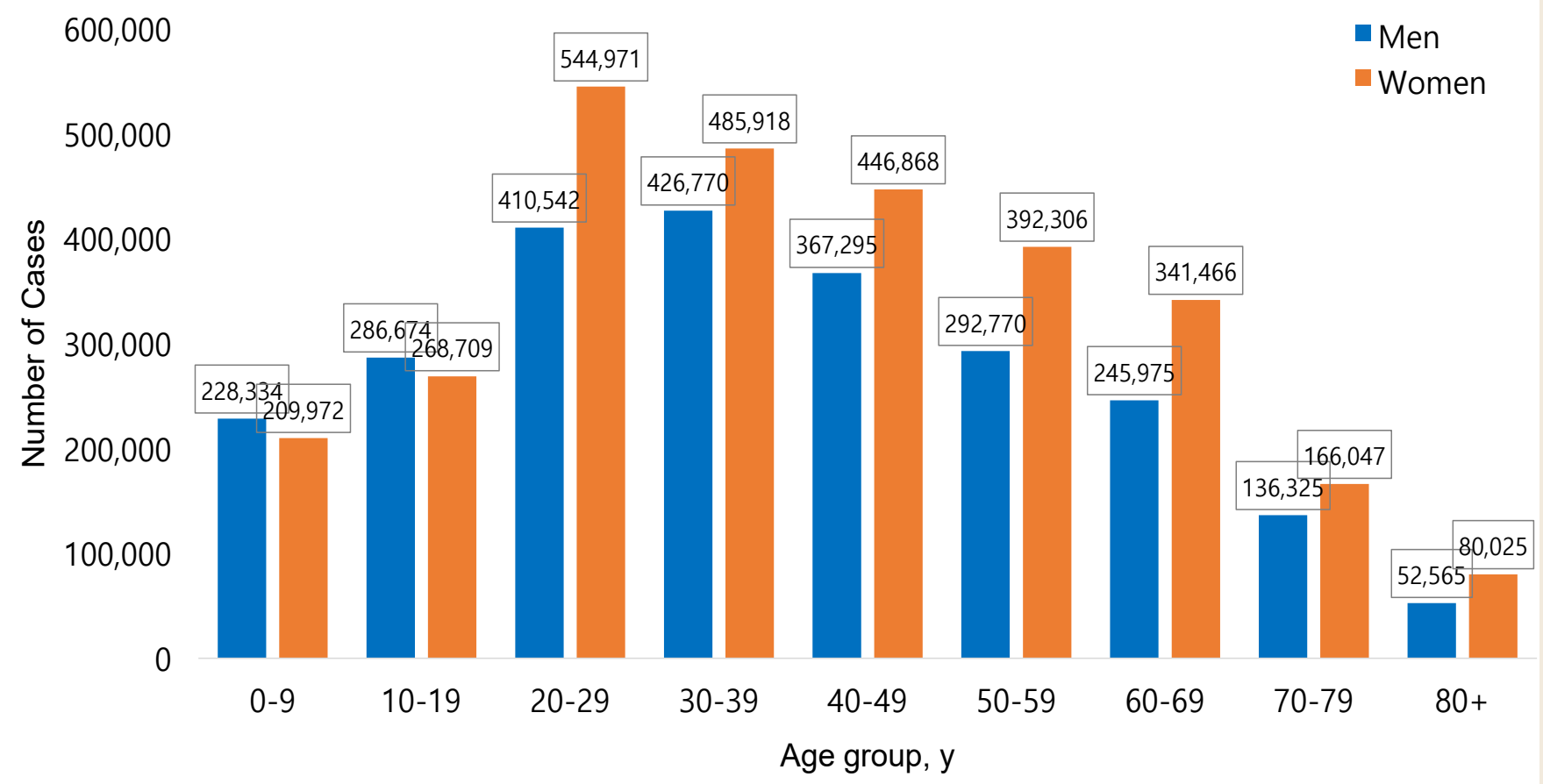
(11.10 ~ 12.7. 2022)



Current Situation of COVID-19 in Seoul

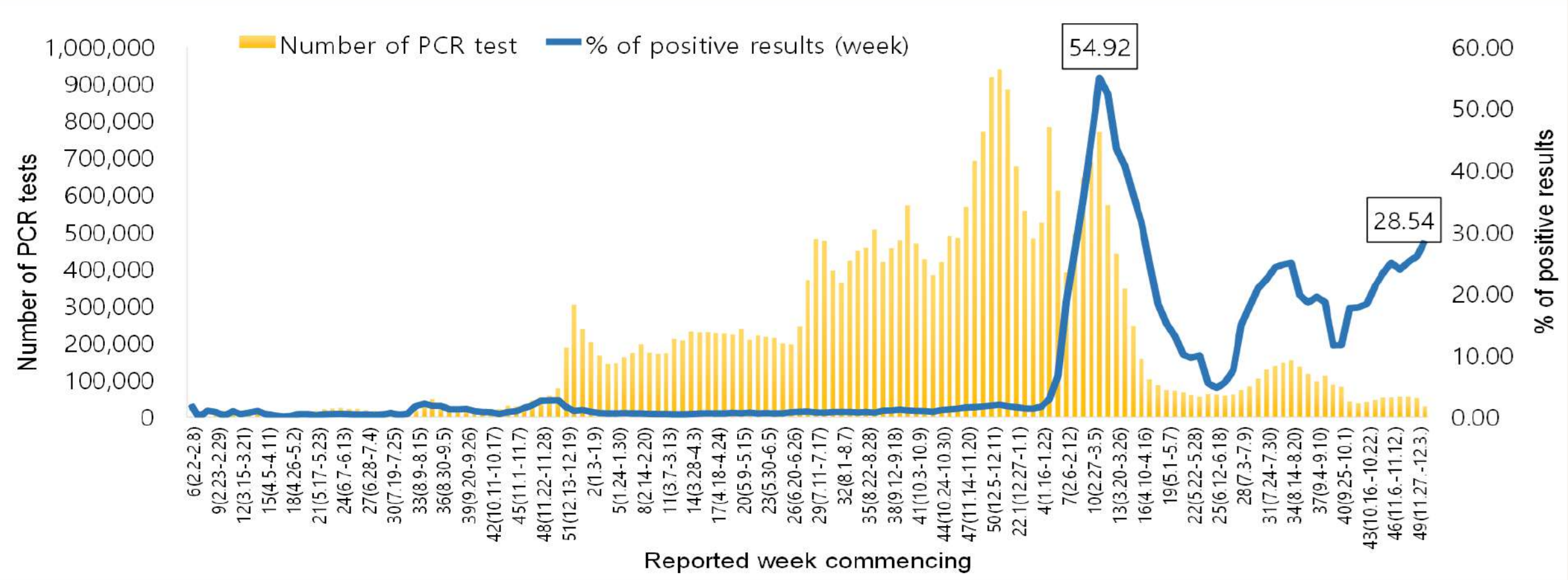
The gender and age of COVID-19 cases based on cumulative data





Current Situation of COVID-19 in Seoul

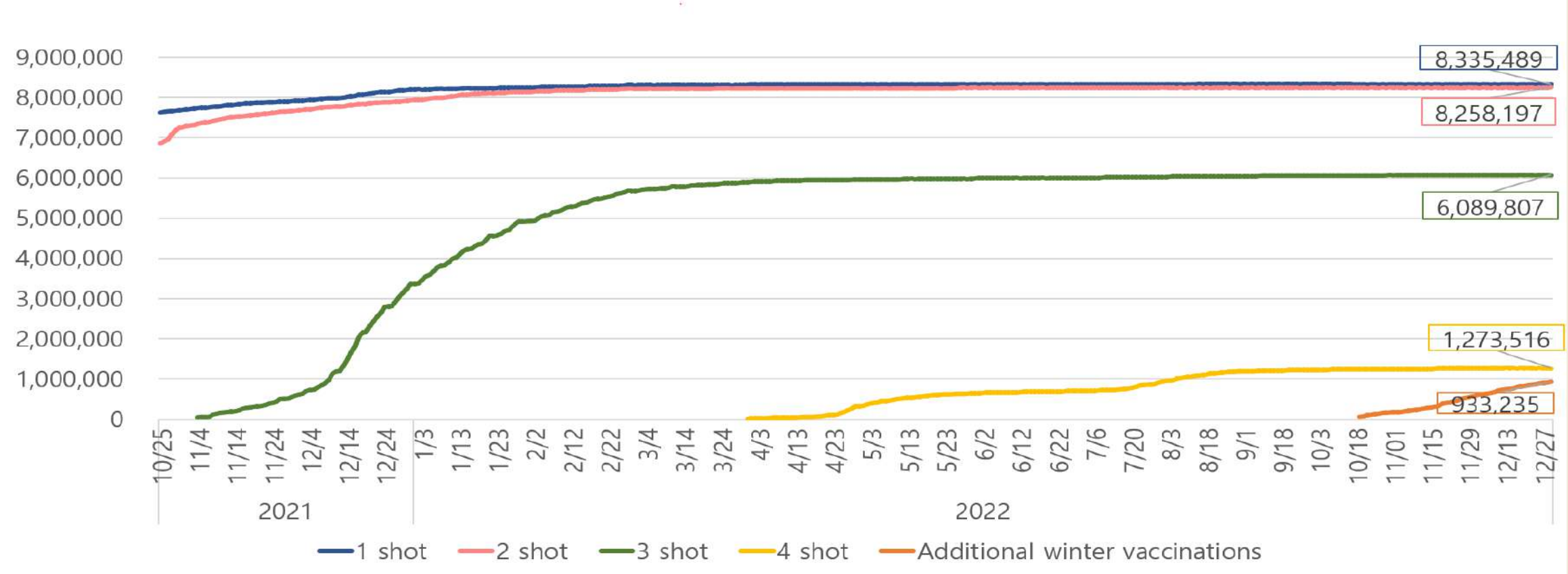
Number of PCR tests conducted weekly and the percentage of confirmed cases by test for the past year



Current Situation of COVID-19 in Seoul

COVID-19 Vaccination status (1st, 2nd, 3rd, 4th shot and additional winter shot)

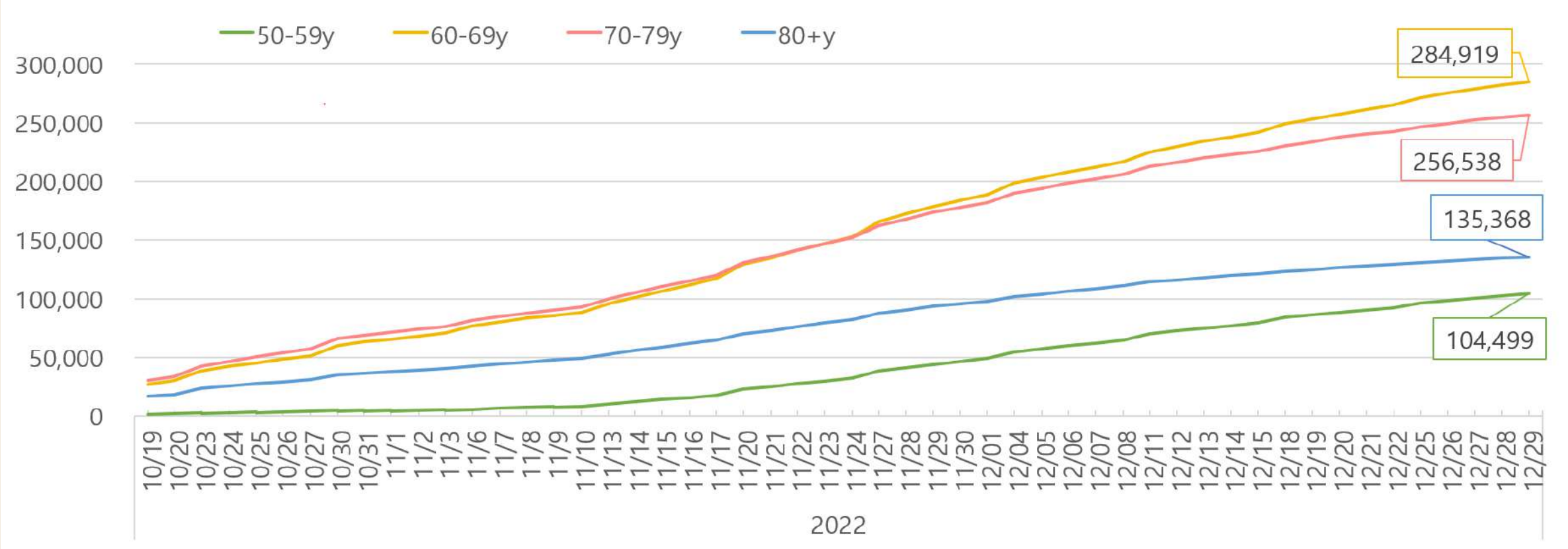
Over the past year or more, the vaccination rate of Seoul citizens has been decreasing.



Current Situation of COVID-19 in Seoul

Additional winter vaccination for people over 50 years old

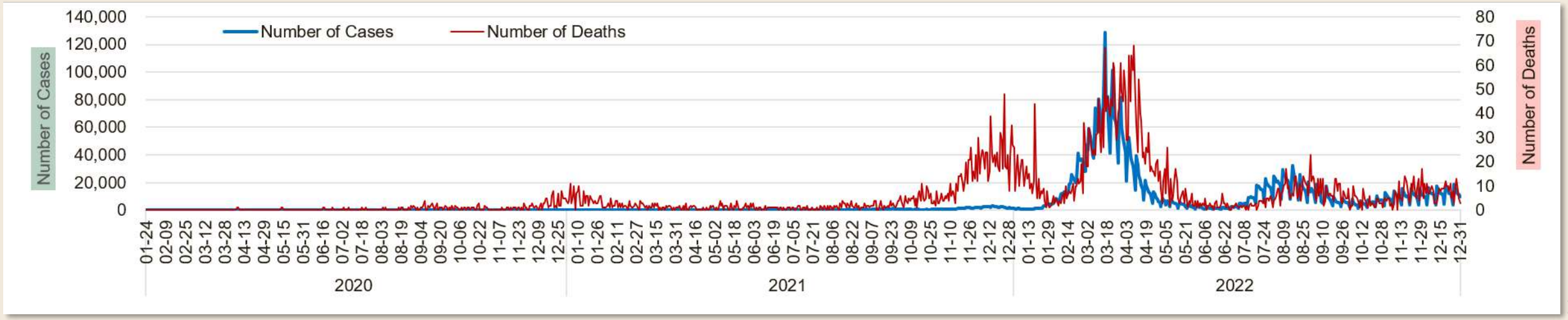
Since the end of last year, the COVID-19 bivalent vaccine has been given mainly to the elderly, and residents of nursing hospitals and various facilities, and the vaccination rate has been gradually increasing.



Current Situation of COVID-19 in Seoul

Confirmed cases and deaths related to COVID-19 for the last 3 years (Dec. 31, 2022, 24:00)

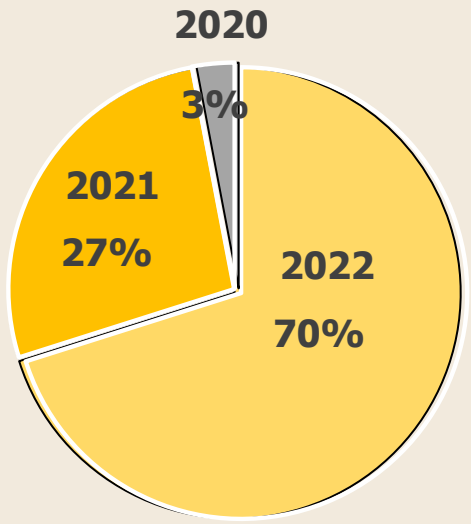
Category	2020	2021	2022
Characteristics	The number of confirmed cases increased during fall and winter seasons		Due to the spread of the omicron variant, the number of confirmed cases has increased in the spring
Maximum number of Confirmed cases per day	552 (Dec. 24, 2021)	3,165 (Dec. 14, 2021)	128,342 (March 16, 2022)
Maximum number of Death cases per day	8 (Dec. 21-28, 2020 3rd wave)	48 (Dec, 24, 2021 4th wave)	68 (April 4, 2022., 6th wave)



Current Situation of COVID-19 in Seoul

General characteristics of COVID-19 related death cases for the last 3 years
(Dec. 31, 2022, 24:00)

		Cumulative Deaths		2020		2021		2022	
Total		6,065	(100.0)	182	(100.0)	1,631	(100.0)	4,252	(100.0)
Gender	Male	3,294	(54.3)	105	(57.7)	923	(56.6)	2,266	(53.3)
	Female	2,771	(45.7)	77	(42.3)	708	(43.4)	1,986	(46.7)
Age	≥59	484	(8.0)	69	(37.9)	119	(7.3)	356	(8.4)
	60–69	865	(14.3)	20	(11.0)	287	(17.6)	558	(13.1)
	70–79	1626	(26.8)	8	(4.4)	515	(31.6)	1043	(24.5)
	80≤	3,090	(50.9)	85	(46.7)	710	(43.5)	2,295	(54.0)



<Distribution of COVID-19 Deaths in Seoul by Year>

Current Situation of COVID-19 in Seoul

Analysis of COVID-19 related deaths based on cumulative data

(Dec. 31, 2022, 24:00)

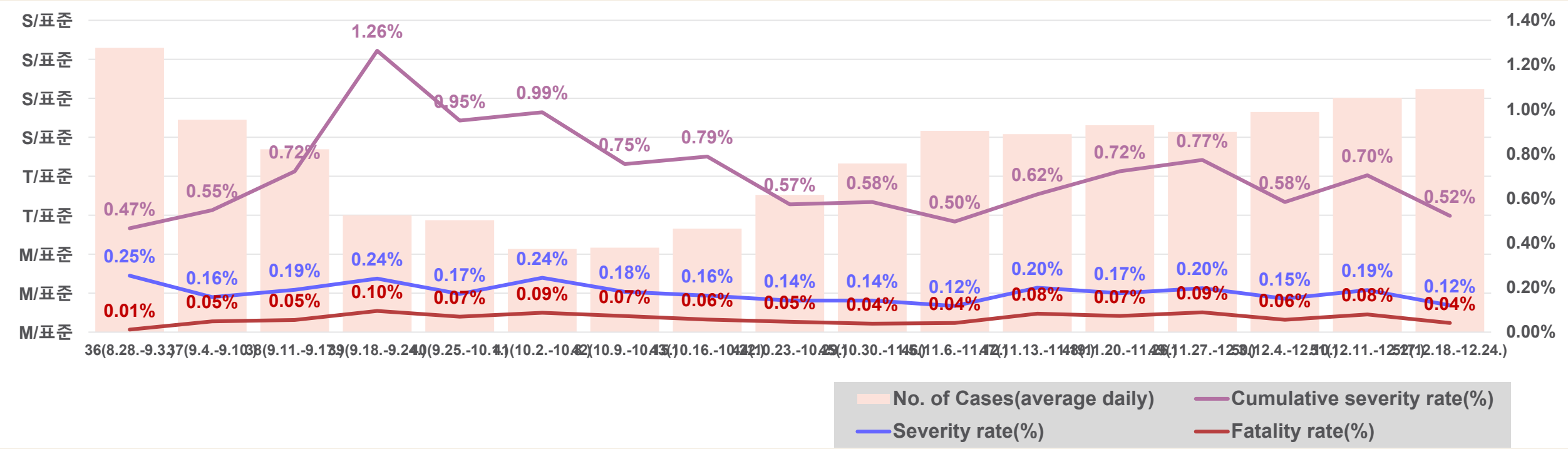
		Total Deaths		Deaths				p-value (M vs F)
				Male		Female		
Total		6,065	(100.0)	3,294	(100.0)	2,771	(100.0)	
Age (average ± standard deviation)		77.8±12.7		75.3±12.3		80.7±12.6		<.0001
Age	0–19	10	(0.2)	6	(0.2)	4	(0.1)	<.0001
	20–59	474	(7.8)	308	(9.4)	166	(6.0)	
	60 and older	5,581	(92.0)	2,980	(90.5)	2,601	(93.9)	
Underlying Disease	Absent	1,321	(21.8)	708	(21.5)	613	(22.1)	0.5741
	Present	4,744	(78.2)	2,586	(78.5)	2,158	(77.9)	
Time of Confirmation of COVID-19	Before Delta	513	(8.5)	295	(9.0)	218	(7.9)	0.0347
	Delta	1,639	(27.0)	921	(28.0)	718	(25.9)	
	BA.1	1,591	(26.2)	826	(25.1)	765	(27.6)	
	BA.2	1,308	(21.6)	688	(20.9)	620	(22.4)	
	BA.5	1,014	(16.7)	564	(17.1)	450	(16.2)	
No. of vaccinations	Unvaccinated	2,985	(49.2)	1,521	(46.2)	1,464	(52.8)	<.0001
	First	220	(3.6)	127	(3.9)	93	(3.4)	
	Second	1,115	(18.4)	665	(20.2)	450	(16.2)	
	Third	1,387	(22.9)	785	(23.8)	602	(21.7)	
	Fourth	331	(5.5)	182	(5.5)	149	(5.4)	
	Confirmation required	27	(0.5)	14	(0.4)	13	(0.5)	

- (Items investigated with regards to underlying disease) Six items were investigated with regards to underlying conditions: ① Hypertension (41.9%, 2,541 persons); ② Diabetes (28.0%, 1,696 persons); ③ Dementia (16.1%, 978 persons); ④ Cancer (14.5%, 880 persons); ⑤ Kidney disease (10.6%, 634 persons); and ⑥ Other diseases (53%, 3,209 persons).

Current Situation of COVID-19 in Seoul

COVID-19 related cases of critical illness and death for the last 4 months

(September 1, 2022 – December 26, 2022)



† (Severity rate) = (new cases of critical illness + death) / (confirmed cases)

‡ (Fatality rate) = (deaths) / (confirmed cases)

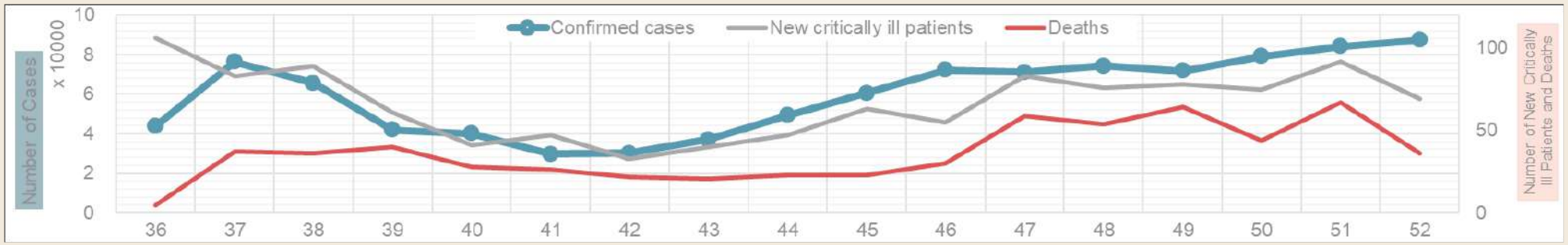
※ The number of confirmed cases is based on date of COVID-19 confirmation

Current Situation of COVID-19 in Seoul

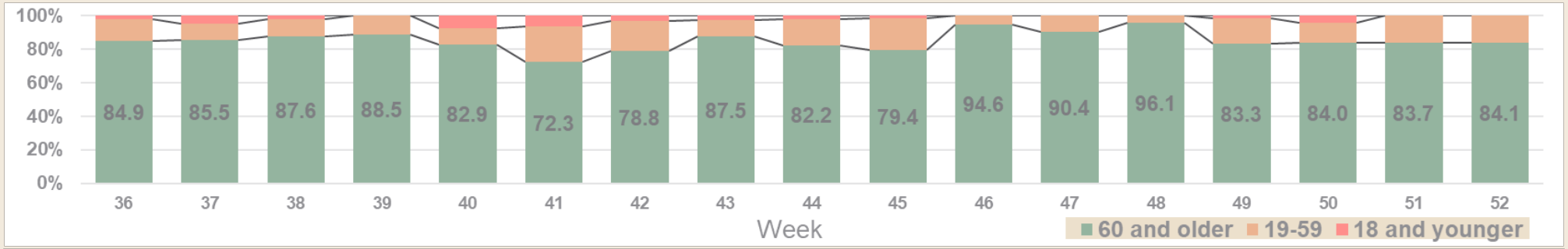
2. Analysis of the Current COVID-19 Situation (Dec. 27, 2022, 24:00)

Key indicators related to critical illness and death for the past 4 months (September 1, 2022 – December 26)

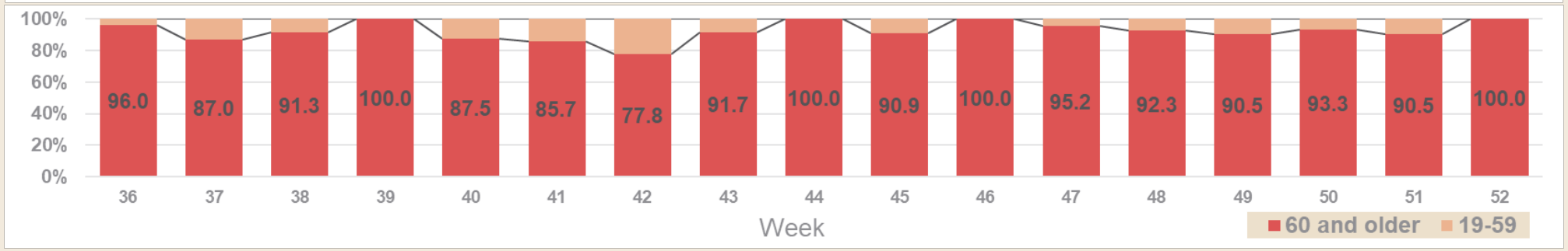
Trends in the number of new confirmed cases, critical illness cases and death related to COVID-19 infection in Seoul



Critical illness cases related to COVID-19 in Seoul by age group



Deaths related to COVID-19 in Seoul by age group



Current Situation of COVID-19 in Seoul

COVID-19 related cases of critical illness and death for the last 4 months

(September 1, 2022 – December 26, 2022)

Category		Number	Gender				p-value
			Male		Female		
Total		1,136(100.0)	646	(100.0)	490	(100.0)	
Gender	Male	646(56.9)					
	Female	490(43.1)					
Average age†		73.7±16.7	70.6±17.3		77.7±14.9		<.0001*
Age	0-9	14(1.2)	11	(1.7)	3	(0.6)	<.0001
	10-19	9(0.8)	7	(1.1)	2	(0.4)	
	20-29	10(0.9)	7	(1.1)	3	(0.6)	
	30-39	12(1.1)	10	(1.6)	2	(0.4)	
	40-49	41(3.6)	27	(4.2)	14	(2.9)	
	50-59	78(6.9)	56	(8.7)	22	(4.5)	
	60-69	184(16.2)	116	(18.0)	68	(13.9)	
	70-79	284(25.0)	192	(29.7)	92	(18.8)	
	80 ≤	504(44.4)	220	(34.1)	284	(58.0)	

Current Situation of COVID-19 in Seoul

COVID-19 related cases of critical illness and death for the last 4 months

(September 1, 2022 – December 26, 2022)

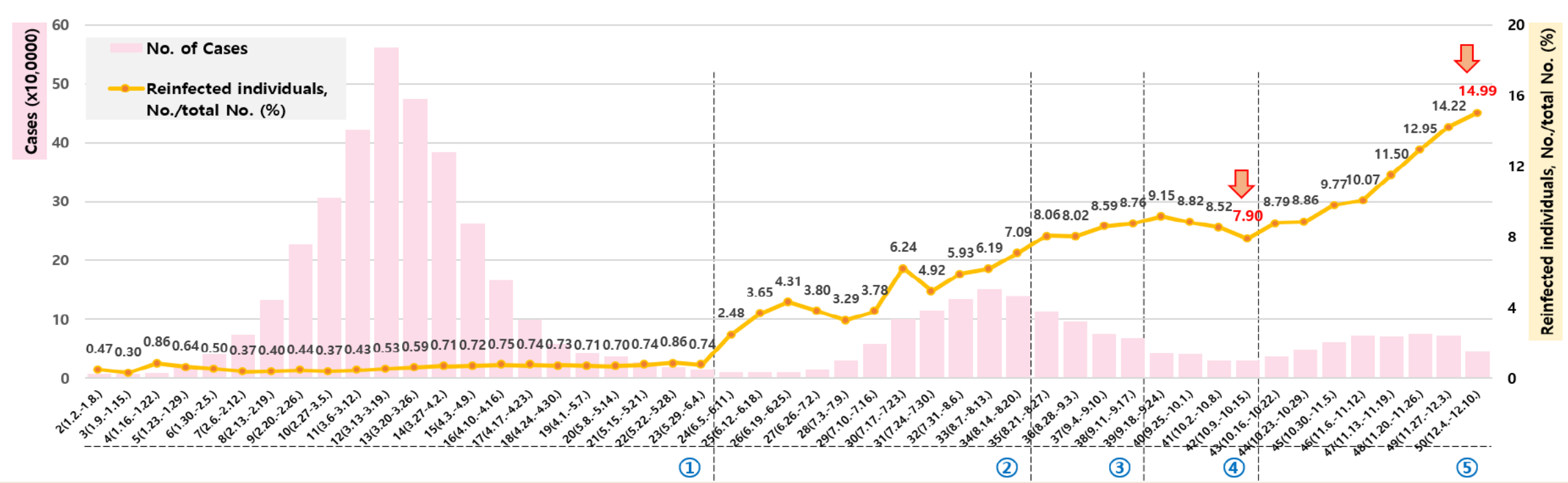
Category		Number	Gender		p-value
			Male	Female	
Total		1,136(100.0)	646(100.0)	490(100.0)	
Number of vaccinations*	unvaccinated	110(9.7)	57(8.8)	53(10.8)	0.1625
	1	23(2.0)	13(2.0)	10(2.0)	
	2	95(8.4)	66(10.2)	29(5.9)	
	3	297(26.1)	168(26.0)	129(26.3)	
	4	289(25.4)	158(24.5)	131(26.7)	
	currently vaccinating**	322(28.4)	184(28.5)	138(28.2)	
Deaths		270(23.8)	147(22.8)	123(25.1)	0.3954
Number of days from confirmation until moderate severity symptoms‡		-1.4±2.2	-1.4±2.1	-1.5±2.4	0.4232*
Number of days from moderate severity symptoms until critical illness‡		7.5±5.3	7.7±5.6	7.3±4.7	0.2900*
Number of days from confirmation until critical illness‡		6.1±5.3	6.2±5.4	6.1±5.2	0.6547*
Number of days from critically illness until death‡		4.8±5.3	5.4±6.0	4.1±4.4	0.0293*

*(Number of vaccinations) The proportion of unvaccinated people among all critically ill patients - 9.7% (110 people), the amount of women accounted for 10.8% and men for 8.8%, but the difference between genders was not statistically significant. However, currently 28.3% of the data is 'under investigation', and a new analysis is necessary to be conducted in the future. **Currently, 28.3% of the data is 'under investigation', and a new analysis is necessary to be conducted in the future, also an additional analysis of the relation between high women mortality among and non-vaccination rate among critically ill patients is needed. **(Under investigation) Currently under investigation, not available for analysis. Subject to change in the future. Out of 791 confirmed cases, in 771 cases the day of symptoms onset was confirmed and analyzed ||Analysis based on 270 death cases.

Current Situation of COVID-19 in Seoul

Presumed reinfection cases in the last year

(Dec. 7, 2022, 24:00)



① Remained at less than 1% throughout the first half of 2022

② (Increase) It started to increase after the second week of June (2.48%)

③ (Stagnation) Since the fourth week of August, it remained above 8% for approx. four weeks

④ (Decrease) It gradually decreased after the third week of September (9.15%)

⑤ (Resurge) Beginning in the second week of October (7.90%), an upward trend emerged

Current Situation of COVID-19 in Seoul

General characteristics of presumed COVID-19 second infection cases for the last 3 months (Dec. 7, 2022, 24:00)

		Octobe			November			December		
		Total confirmed cases	Presumed second infection cases		Total confirmed cases	Presumed second infection cases		Total confirmed cases	Presumed second infection cases	
		n	n	%*	n	n	%*	n	n	%*
Total		166,402	14,342	8.6%	303,516	35,237	11.6%	75,188	11,272	15.0%
Gender	Male	71,004	5,774	8.1%	128,835	13,559	10.5%	32,186	4,503	14.0%
	Female	95,398	8,568	9.0%	174,681	21,678	12.4%	43,002	6,769	15.7%
Age	0–9	8,938	1,929	21.6%	15,414	3,607	23.4%	3,869	987	25.5%
	10–19	17,101	2,769	16.2%	28,587	5,591	19.6%	7,680	1,875	24.4%
	20–29	25,577	2,152	8.4%	49,480	6,139	12.4%	12,721	2,093	16.5%
	30–39	27,793	2,269	8.2%	52,274	5,947	11.4%	13,585	2,064	15.2%
	40–49	24,856	1,753	7.1%	45,486	4,578	10.1%	11,404	1,539	13.5%
	50–59	22,274	1,122	5.0%	41,183	3,187	7.7%	10,073	966	9.6%
	60–69	20,838	1,333	6.4%	37,419	3,479	9.3%	8,580	981	11.4%
	70–79	12,872	626	4.9%	22,228	1,675	7.5%	4,801	486	10.1%
	80 and older	6,153	389	6.3%	11,445	1,034	9.0%	2,475	281	11.4%
Facilities vulnerable to infection	Convalescent hospital	442	123	27.8%	1,091	445	40.8%	230	112	48.7%
	Convalescent facilities	406	91	22.4%	942	316	33.5%	205	70	34.1%

(%) The total number of confirmed cases, that is the row percentage, was calculated ※ Analysis was performed based on the data currently accessible; however, all analysis results are subject to change based on future epidemiological investigation findings. (The number of vaccinations will be continually updated and analyzed subsequently.)

Current Situation of COVID-19 in Seoul

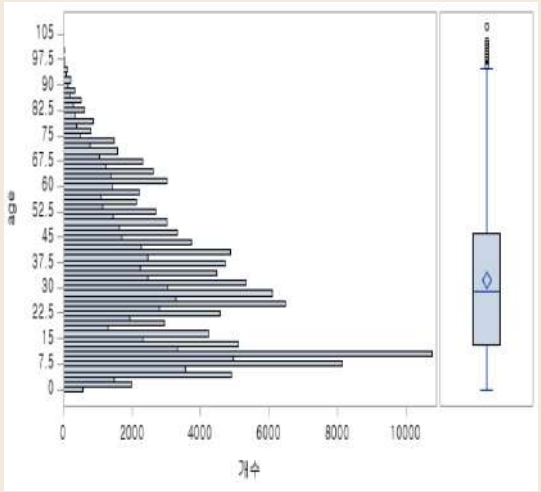
General characteristics of presumed COVID-19 second infection cases for last 3 months (Dec. 7, 2022, 24:00)

		October			November			December		
		Total confirmed cases	Presumed second infection cases		Total confirmed cases	Presumed second infection cases		Total confirmed cases	Presumed second infection cases	
		n	n	%*	n	n	%*	n	n	%*
Total		166,402	14,342	8.60%	303,516	35,237	11.60%	75,188	11,272	15.00%
Deaths		103	8	7.8%	207	22	10.6%	9	3	33.3%
No. of vaccinations	Unvaccinated	11,203	2,558	22.8%	7,824	1,864	23.8%	0		
	First	1,296	188	14.5%	2,498	454	18.2%	0		
	Second	33,507	2,962	8.8%	57,289	7,168	12.5%	0		
	Third	82,868	5,384	6.5%	141,568	13,675	9.7%	0		
	Fourth	20,451	983	4.8%	35,379	2,669	7.5%	0		
	Fifth	215	14	6.5%	156	4	2.6%	0		
	In review	16,862	2,253	13.4%	58,802	9,403	16.0%	75,188		
Total			14,342	100.0%		35,237	100.0%		11,272	100.0%
Time of initial infection	Before Delta		360	2.5%		726	2.1%		189	1.7%
	Delta		1,520	10.6%		3,004	8.5%		814	7.2%
	BA.1		8,389	58.5%		19,946	56.6%		6,149	54.6%
	BA.2		3,798	26.5%		10,516	29.8%		3,696	32.8%
	BA.5		275	1.9%		1,045	3.0%		424	3.8%
Time of reinfection (average ± standard deviation)			242.2±85.2			263.6±80.3			275.0±78.3	

* (%*) The total number of confirmed cases, that is the row percentage, was determined ※ Analysis was performed based on the data currently accessible; however, all analysis results are subject to change based on future epidemiological investigation findings. (The number of vaccinations will be continually updated and analyzed subsequently.)

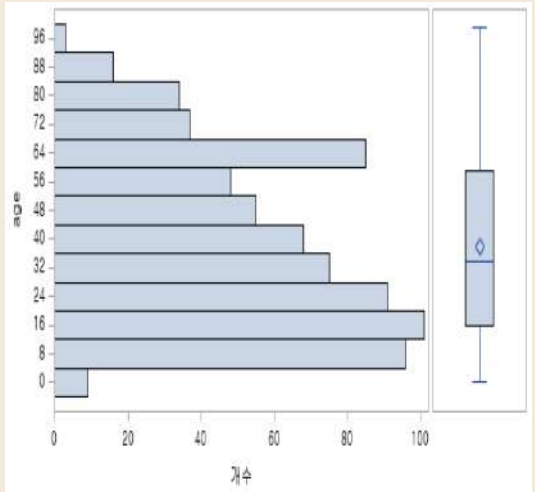
Current Situation of COVID-19 in Seoul

In-depth analysis of presumed COVID-19 reinfection cases based on cumulative 160,415 cases (Dec. 7, 2022, 24:00)



(The second infection)

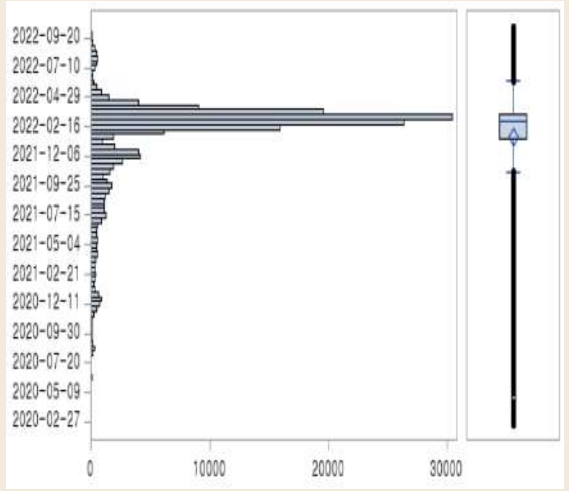
☞ The second infection was very high, mainly in the age group of children and adolescents between the ages of 5 and 15.



(The third infection)

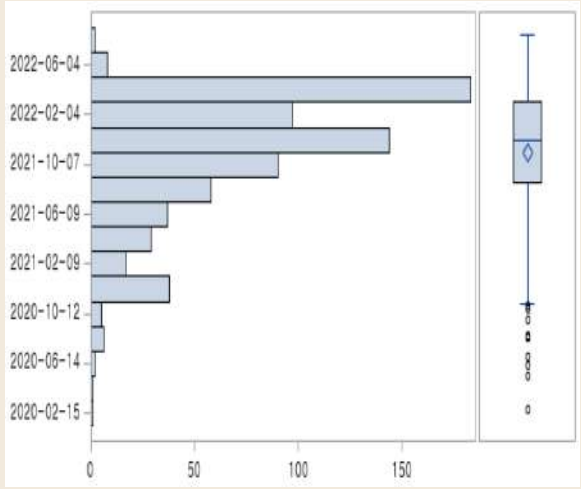
☞ The third infection occurred a lot in the younger age, but it was relatively evenly distributed across all ages compared to the second infection.

<Age Distribution of Presumed Reinfection Cases, Histogram>



(The second infection)

☞ The first infection of the second infection occurred most frequently from February to April 2022, when the Omicron BA.1 and BA.2 variants were prevalent.



(The third infection)

☞ The first infection of the third infection occurred most frequently from October 2021 to May 2022, when the Delta variant, Omicron BA.1 and BA.2 variants were prevalent.

<Distribution of Time of Initial Infection, Histogram>

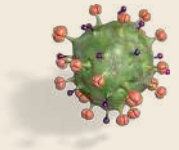
Current Situation of COVID-19 in Seoul

Status of Outbreaks in Nursing Hospitals and Facilities (Dec. 19, 2022, 24:00)

		Cumulative confirmed cases over the past three months		Nursing hospital		Nursing facilities	
Total		687,719	(100.0)	2,336	(100.0)	1,759	(100.0)
Gender	Male	292,893	(42.6)	950	(40.7)	264	(15.0)
	Female	394,826	(57.4)	1,386	(59.3)	1,495	(85.0)
Age (Mean±SD*, Years)		41.9±20.7		71.3±14.8		78.1±14.6	
Age	0–9	35,356	(5.1)	0	(0.0)	0	(0.0)
	10–19	66,996	(9.7)	2	(0.1)	0	(0.0)
	20–29	111,374	(16.2)	37	(1.6)	15	(0.9)
	30–39	119,982	(17.5)	39	(1.7)	17	(1.0)
	40–49	103,470	(15.1)	85	(3.6)	38	(2.2)
	50–59	93,030	(13.5)	283	(12.1)	171	(9.7)
	60–69	83,786	(12.2)	572	(24.5)	216	(12.3)
	70–79	49,235	(7.2)	503	(21.5)	224	(12.7)
	80 and older	24,490	(3.6)	815	(34.9)	1,078	(61.3)
Asymptomatic cases		176,568	(25.7)	864	(37.0)	711	(40.4)
Deaths		409	(0.1)	46	(2.0)	17	(1.0)

Current Situation of COVID-19 in Seoul

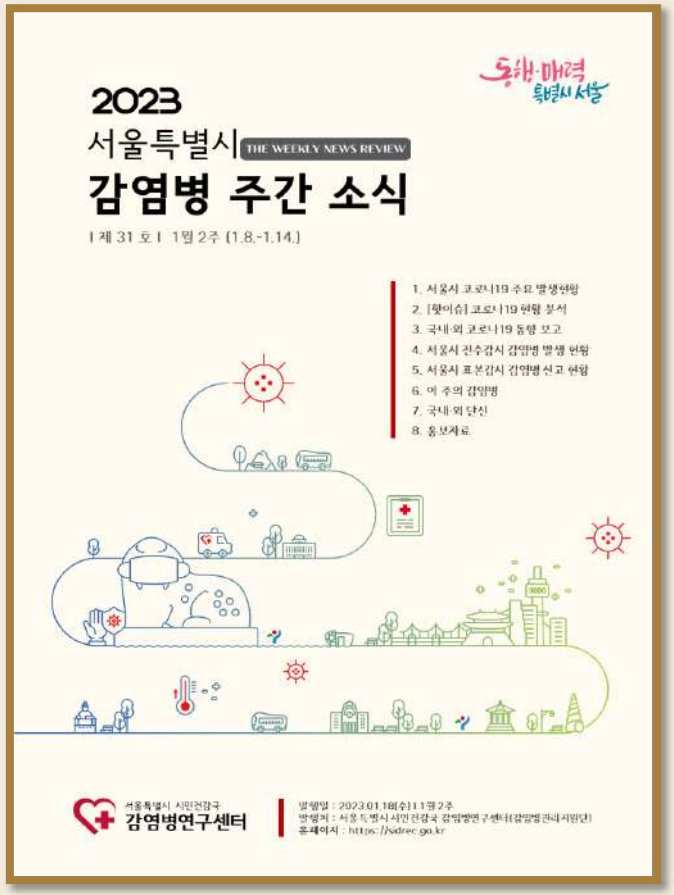
Characteristics of Confirmed Patients in Nursing Hospitals and Nursing Facilities (Oct. 1 – Dec. 19, 2022)

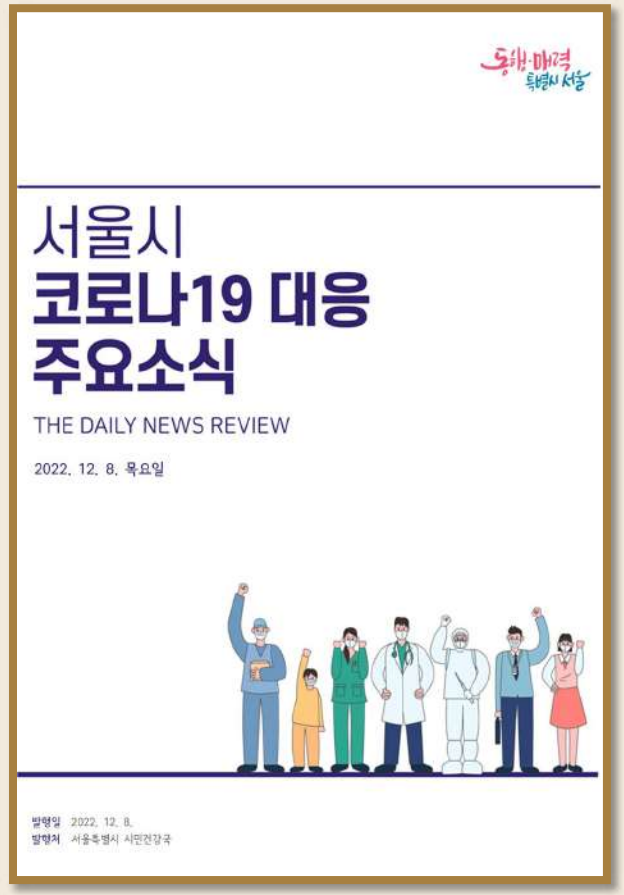


		October		November		December (Dec. 1 - Dec. 19)	
Total		924	(100.0)	2,096	(100.0)	1,075	(100.0)
Institution	Nursing hospital	483	(52.3)	1,141	(54.4)	712	(66.2)
	Nursing facilities	441	(47.7)	955	(45.6)	363	(33.8)
Gender	Male	225	(24.4)	592	(28.2)	397	(36.9)
	Female	699	(75.7)	1,504	(71.8)	678	(63.1)
Age	<60	156	(16.9)	347	(16.6)	184	(17.1)
	60–69	159	(17.2)	411	(19.6)	218	(20.3)
	70–79	161	(17.4)	332	(15.8)	234	(21.8)
	80-89	310	(33.6)	707	(33.7)	291	(27.1)
	90≤	138	(14.9)	299	(14.3)	148	(13.8)
Classification	Patients and residents	652	(70.6)	1,585	(75.6)	794	(73.9)
	Staff	238	(25.8)	511	(24.4)	280	(26.1)
	Other	34	(3.7)	0	(0.0)	1	(0.1)
Asymptomatic cases		339	(36.7)	814	(38.8)	422	(39.3)
Deaths		15	(1.6)	41	(2.0)	7	(0.7)

Provision of Information about Current Situation of COVID-19 in Seoul

- **Type:** The Weekly News Report / The Daily News Report
- **Recipients**: Various bureaus in Seoul, public health centers, municipal hospitals, school authorities, infection experts, etc. in Seoul, etc.
- **Contents:**
  - Recent COVID-19 outbreaks in Seoul
  - In-depth analysis of COVID-19 hot issues
  - Reports on COVID-19 trends at home and abroad
  - Legal infectious diseases other than COVID-19
  - Introduction of infectious diseases selected this week
  - Current infection diseases related news at home and abroad
  - Promotional materials.





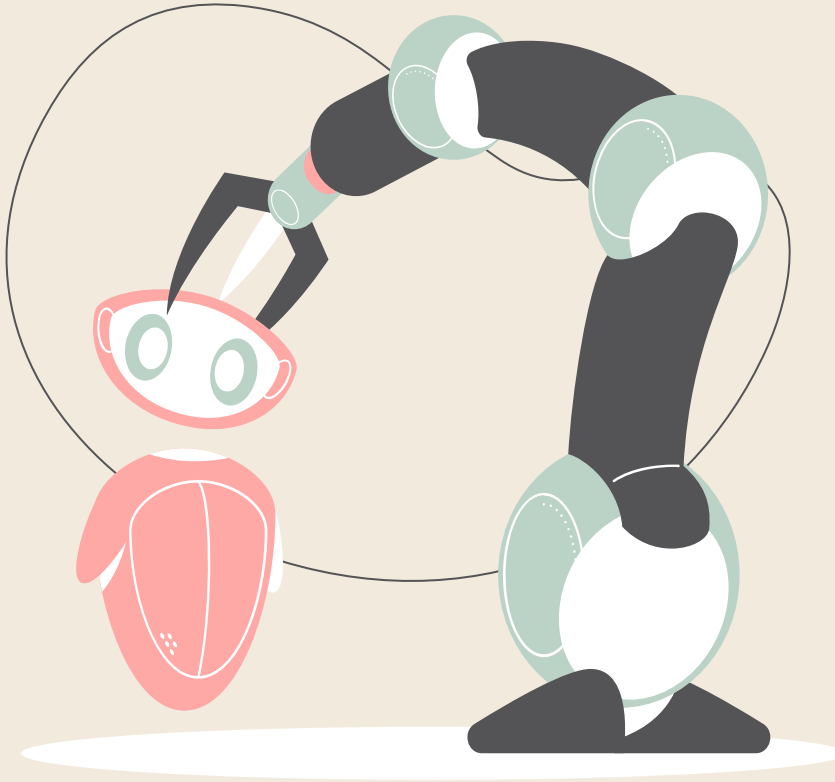
Introduction of RPA-based Work Automation System

□ Outline

RPA (Robotic Process Automation)

Technology that handles formal and repetitive tasks using robots, software, etc.

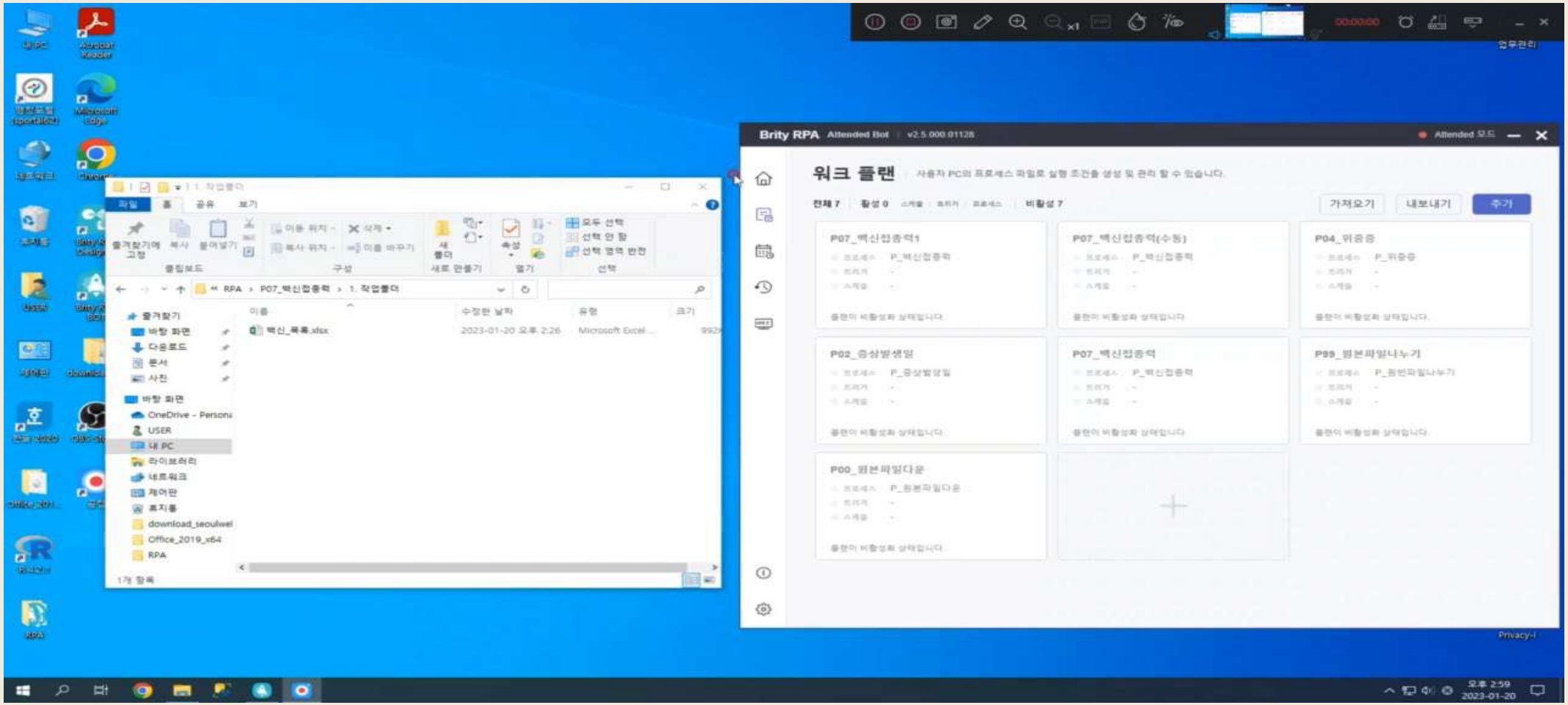
- Purpose: With the number of COVID-19 confirmed cases approaching 6 million, the relevant data is vast, and it takes a lot of time and effort for humans to refine the data.
- Working principle: The robot automatically operates according to the RPA task schedule or algorithm
- Progress: A total of seven automated work systems have been developed, and as the work progresses, checks for malfunctions are underway.
- Expected effectiveness: 429 hours are saved per month by RPA



▶ **(Daily workload comparison) Staff 800/8hr vs RPA 1,200/24hr**
⇒More than 3x faster data cleaning compared to humans

Introduction of RPA-based Work Automation System

Demonstration video



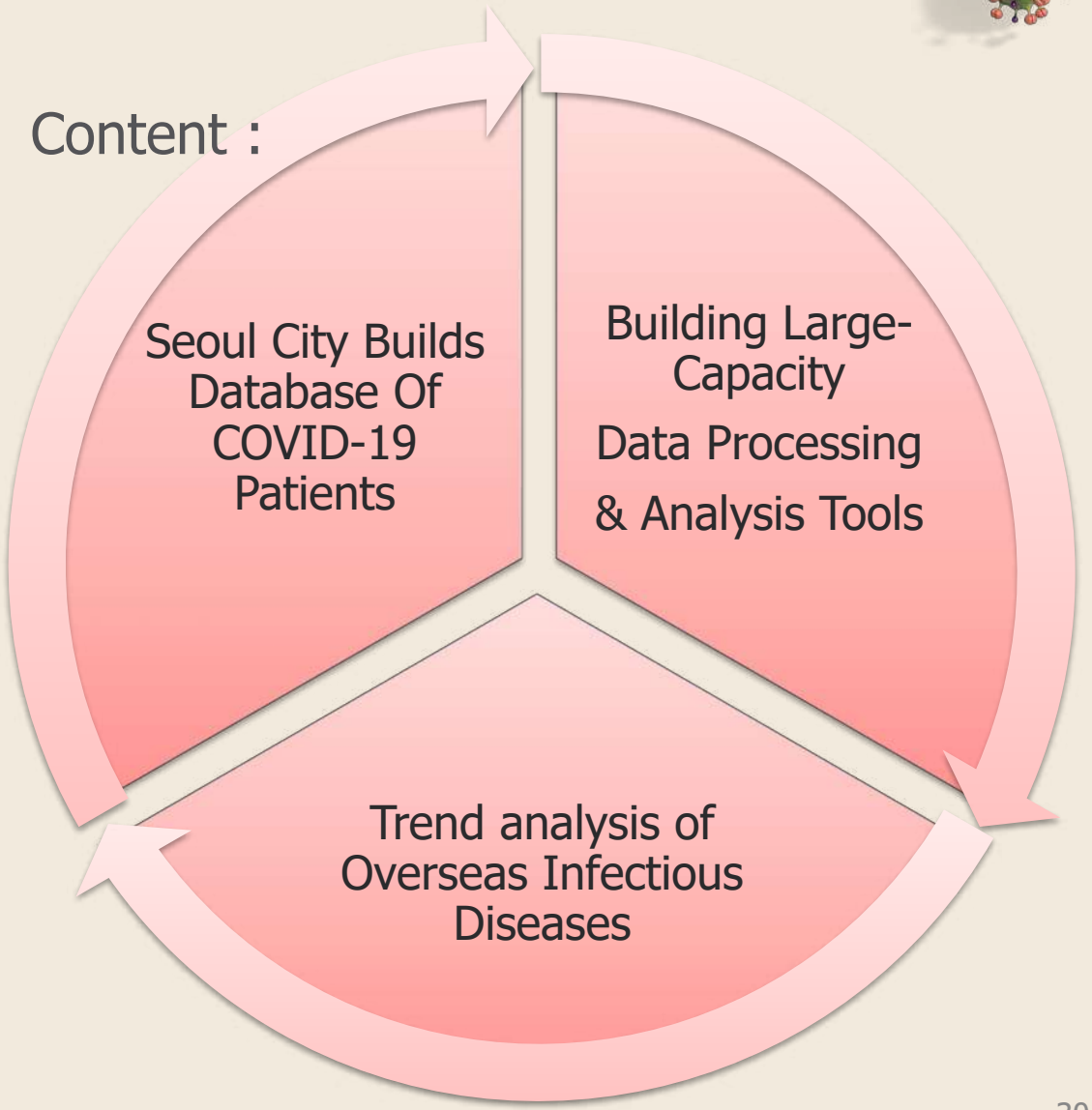
Construction of a System for Integrated Management of Infectious Disease-related Data

□ Project Introduction

- System domain: https://sims.sidrec.go.kr
- Purpose: Comprehensive collection and management of information on COVID-19 confirmed patients in Seoul, which had been managed in segments, so that infectious disease-related personnel can easily access the information and respond quickly.

☞ The personal information of the confirmed patient, symptoms, death, vaccination history, adverse events of vaccine, and bed allocation information can be viewed in a row in Excel.

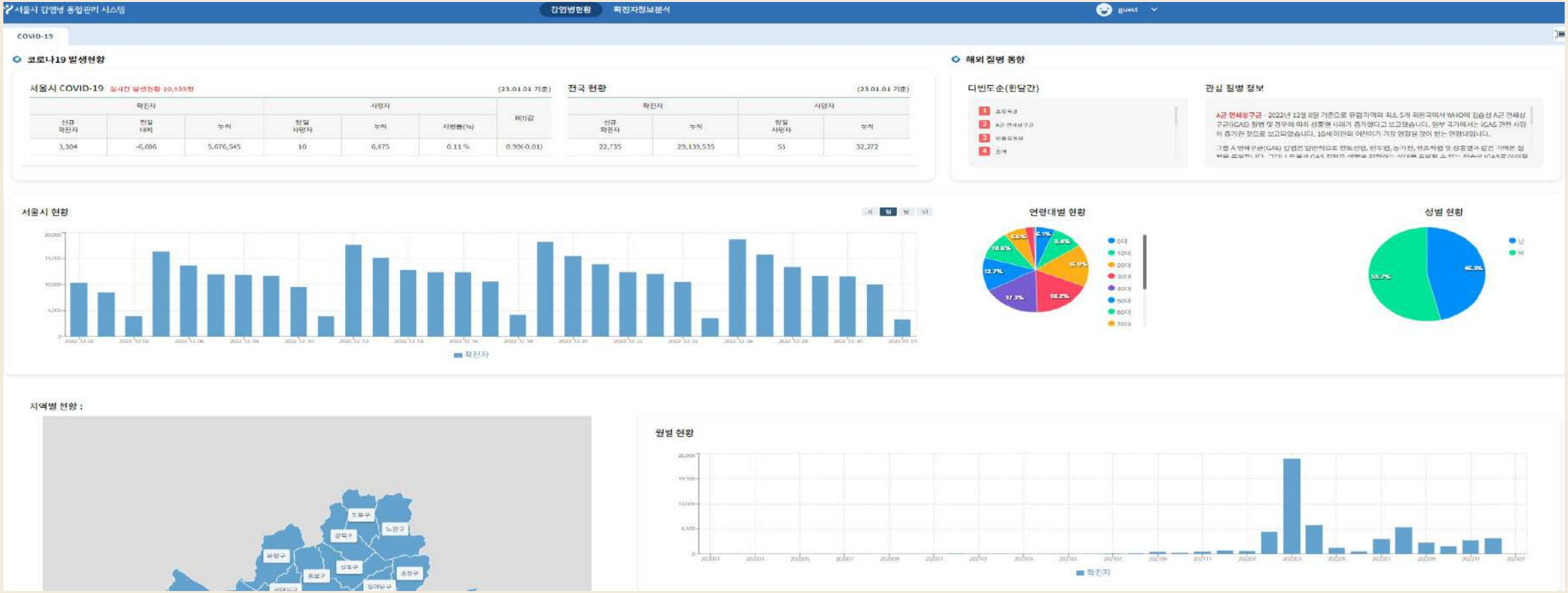
- Future plans: Additional major infectious diseases such as waterborne diseases and tuberculosis will be included in the system.



Construction of a System for Integrated Management of Infectious Disease-related Data

□ System Main Page (Detail)

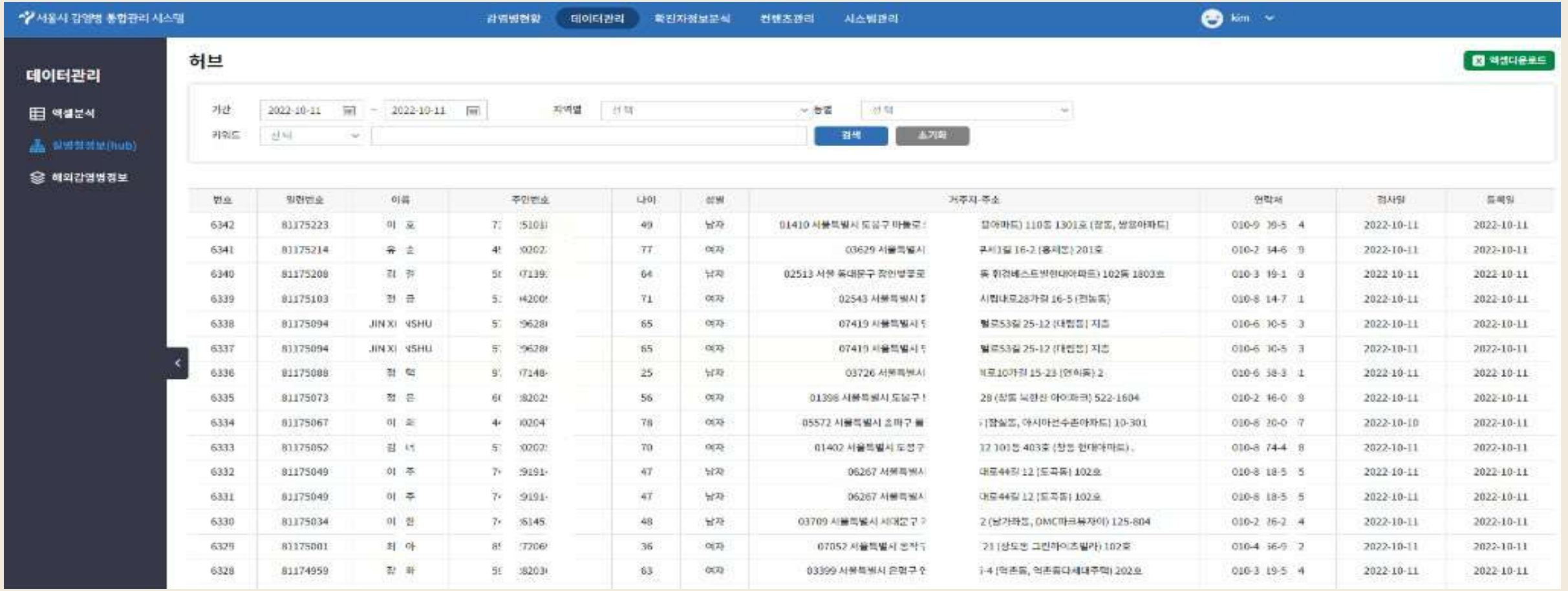
[Bulletin board] The status of COVID-19 confirmed patients in Seoul in real time, COVID-19 situation in 25 districts, and information on epidemic overseas infectious diseases is quickly provided.



Construction of a System for Integrated Management of Infectious Disease-related Data

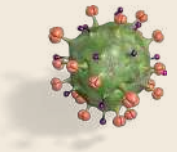
□ System Main Page (Detail)

[Data Supply And Demand] The KDCA's hub system is connected to the Seoul's integrated management system in a DB to DB method to deliver COVID-19 confirmed patients in real time.



* KDCA: Korea Disease Control and Prevention Agency

Construction of a System for Integrated Management of Infectious Disease-related Data

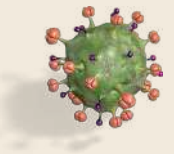


□ System Main Page (Detail)

[Collection of in-depth epidemiological investigations document data] Construction of in-depth epidemiological investigations document(pdf file) database and pdf file download of confirmed cases

☞ Based on this, it can be used to respond to new infectious diseases in the future through spatial research related to the spread of infection in the local community by tracking the movement of confirmed patients.

Construction of a System for Integrated Management of Infectious Disease-related Data



□ System Main Page (Detail)

[Integration of confirmed patient data] hub system + confirmed case ledger + vaccination status + vaccine=related adverse reaction + death situation + bed assignment + in-depth epidemiological investigation note