

Supplementary Material*

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Supplement. Supplementary Appendix

Supplement Figure 1. Chronological order of events of the outbreak and our subsequent investigations.

Supplement Figure 2. Epidemic curve for Guangzhou city of a population of 14.9 million (25).

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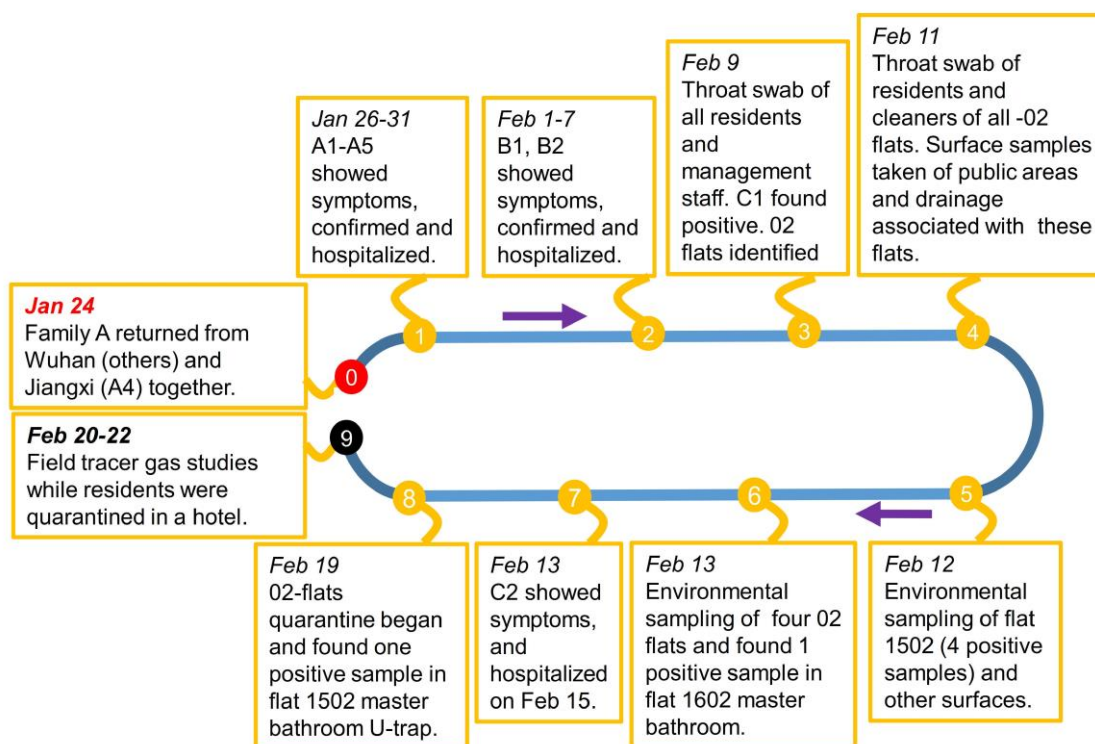
Supplement Table 5. Master Bathroom Usage Habits by Phone Survey of 16 Families Living in -02 Flats (Excluding 1502)

Supplement Table 6. Exposure of Residents in Block X to Family A in Lifts*

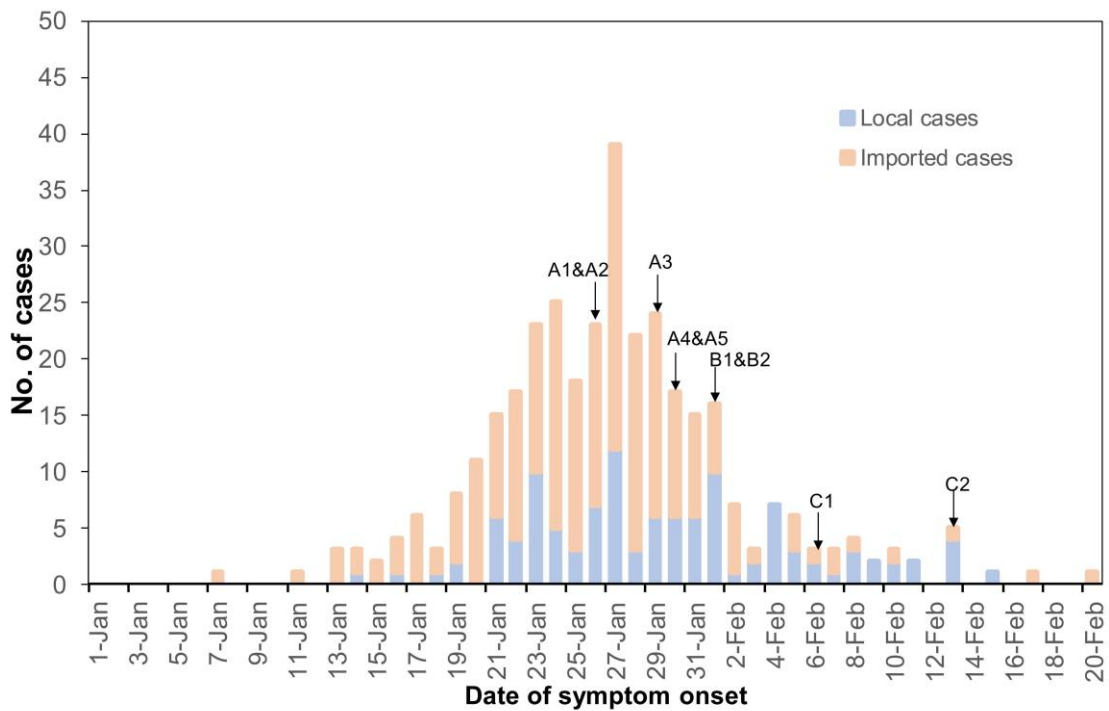
* This supplementary material was provided by the authors to give readers further details on their article. The material was reviewed but not copyedited.

Supplementary Appendix

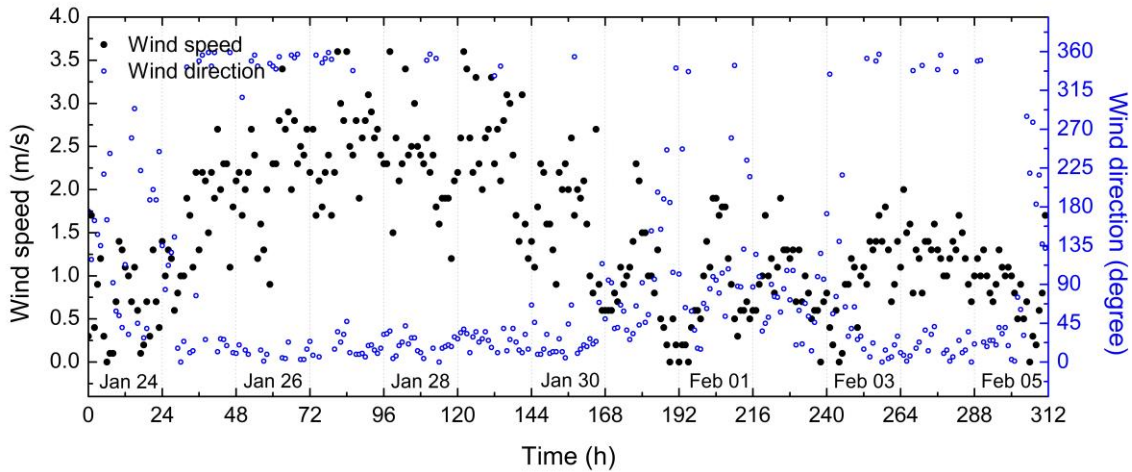
The Supplementary Appendix consists of a chronological order of the events (Supplement Figure 1), epidemic curve for Guangzhou city (Supplement Figure 2), weather data (Supplement Figure 3), wind-induced pressure around Building X (Supplement Figure 4), resident and patient information in Building X (Supplement Tables 1 to 3), list of surface samples (Supplement Table 4), usage data on public elevators (Supplement Table 5), and resident behavior survey in using bathtubs and flat odors survey (Supplement Table 6).



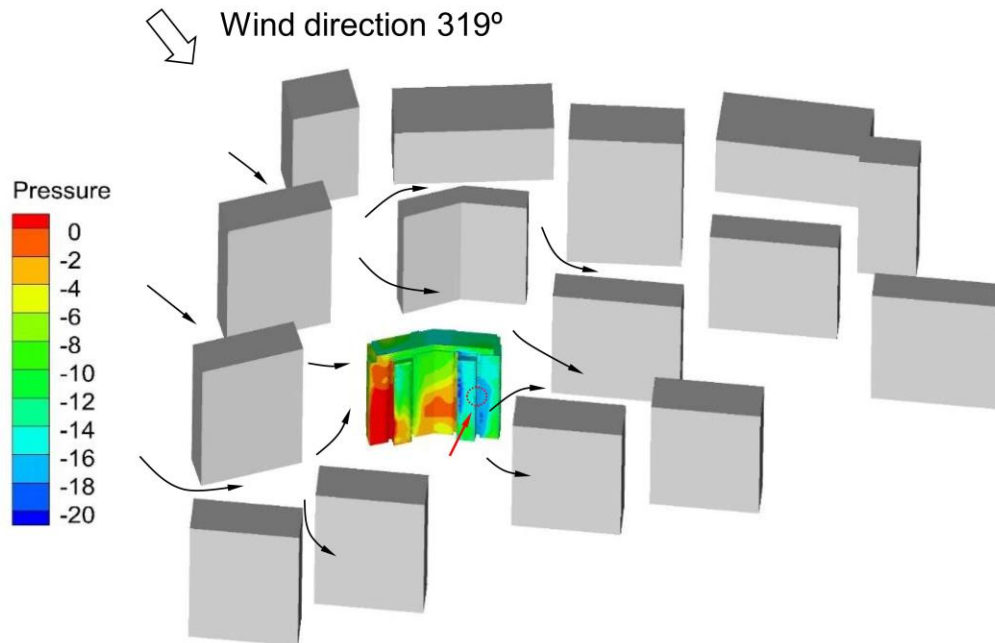
Supplement Figure 1. Chronological order of events of the outbreak and our subsequent investigations. The studies were mostly conducted as a part of an emergency act. Specific ethical approval was not needed, as the study was a part of investigations by Guangdong CDC into the COVID-19 epidemic.



Supplement Figure 2. Epidemic curve for Guangzhou city of a population of 14.9 million (25). Date of symptom onset of the investigated nine cases are marked.



Supplement Figure 3. Wind speed and wind direction measured by the nearest weather station to the Block X housing estate (0° and 360° for North, 90° for East, etc.).



Supplement Figure 4. Wind pressure distribution around Block X as predicted by considering surrounding buildings. The RNG $k-\varepsilon$ model was adopted in ANSYS Fluent software to solve the velocity and pressure field. For a northwesterly wind (3 m/s), a negative pressure of about 16.8 Pa was found at the balcony of 1602 master bathroom (highlighted by the red arrow); the air pressure in the far field is about zero, windward side of the building is 6.1 Pa, and in the north facade of flat 1602 is -7.1 Pa.

Supplement Table 1. Distribution of Residents in Block X at the Time of Outbreak. All family members in flats 1502 (Family A), 2502 (Family B), and 2702 (Family C) were infected, as highlighted **in bold red**.

Floor	No. of residents		No. of occupied flats		No. of unoccupied flats	
	-02 flats	-01 & -03 flats	-02 flats	-01 & -03 flats	-02 flats	-01 & -03 flats
26F, 28F, 29F*	0	12	0	4	2	2
27F	2	6	1	2	0	0
25F	2	8	1	2	0	0
16F-24F	18	49	5	12	4	6
15F	5	3	1	1	0	1
2F-14F	39	58	11	17	2	9
Total	66	136	19	38	8	18

*There are only two flats on Floor 29, a -01 flat and a -03 flat.

Supplement Table 2. Infection Risks of Residents Living in -01 to -03 Flats of Block X.

All confirmed patients live in -02 flats, suggesting that residents in -02 flats were subjected to a considerably higher infection risk compared to those in -01 and -03.

Flats	Risk (no./total no.)
-02 flats	3/60*
-01 & -03 flats	0/136

* A1–5 (source patients) and C2 (secondary case probably infected by C1) are not included.

Supplement Table 3. Information About the Nine COVID-19 Patients in Block X. Note that in Figure 1A, the suspected infectious period for an infected individual was based on the suggestion of the NHC (2). Asymptomatic infection was also reported by The Novel Coronavirus Pneumonia Emergency Response Epidemiology Team (26).

Family	Serial No.	Gender	Age	Symptom onset	Hospitalization	Confirmation
1502	A1	Male	57	Jan 26	Jan 27	Jan 29
	A2	Female	57	Jan 26	Jan 27	Jan 29
	A3	Female	31	Jan 29	Jan 29	Jan 31
	A4	Male	33	Jan 30	Jan 31	Jan 31
	A5	Male	3	Jan 30	Jan 31	Jan 31
2502	B1	Female	42	Feb 1	Feb 6	Feb 6
	B2	Male	44	Feb 1	Feb 7	Feb 7
2702	C1	Female	50	Feb 6	Feb 9	Feb 9
	C2	Male	52	Feb 13	Feb 15	Feb 15

Supplement Table 4. List of 237 Environmental Surface Samples Except Otherwise Stated

Date	Location within building	Sample location	No. of positive samples	No. of samples
Feb 11 (40 samples)	Block X lobby	Door handles	0	1
	Elevator lobbies, F12-18, 23-29	Elevator buttons	0	14
	Entrance of 1502, 2502, 2702	Door handle and bell	0	3
	Passenger elevators	Interior surfaces	0	1
	Goods elevator	Interior surfaces	0	1
	Wastewater wells	Interior walls	0	3
	Sewage wells	Interior walls	0	3
	Floor drains on the balcony	Interior walls	0	4
	Rooftop	Four vent outlets of the sewage pipes (not -02 flats)	0	4
	Rooftop	Vent pipes of wastewater pipe and fume pipe for the kitchen (not 02-flats)	0	2
Rooftop (air samples)	Vent pipe air	0	4	
Feb 12 (38 samples)	Flat 1502	Door handle and light switch at the flat entrance	0	1
		Frequently touched surfaces in the living room	0	9
		Discarded diaper in the living room	0	1
		Door handle, light switch, and remote controller in the master bedroom	1	1
		Light switch in the guest bathroom/study and closet handle in the guest room	0	1
		Door handle, keyboard and screen of the study	0	2
		Frequently touched surfaces in master bathroom	3	4
		Floor drain and mop in the master bathroom	0	2
Door handle, washbasin, and tumbler in the guest bathroom	0	2		

	Floor drain in the guest bathroom	0	1		
	Three air supply inlets in the living room, master bedroom and guest room	0	3		
	Elevator lobbies, F16, 27, 28	Air supply inlets	0	6	
	Passenger elevator	Air supply inlets	0	1	
	Goods elevator	Air supply inlets	0	1	
	Rooftop	Air exhaust of the two elevators	0	1	
	Rooftop: elevator room	Floor and phone	0	1	
		Equipment surfaces	0	1	
Feb 13 (101 samples)	1402	Frequently touched surfaces, air supply inlets, drains, etc.	0	25	
	1402 (air samples)	Floor drain air in master and guest bathrooms	0	2	
	1602	Frequently touched surfaces, air supply inlets, drains, etc.	1	15	
	1602 (air samples)	Floor drain air in master and guest bathrooms	0	2	
	1702	Frequently touched surfaces, air supply inlets, drains, etc.	0	20	
	1702 (air samples)	Floor drain air in master and guest bathrooms	0	1	
	2802	Frequently touched surfaces, air supply inlets, drains, etc.	0	24	
	2802 (air samples)	Floor drain air in master and guest bathrooms	0	2	
		Four elevator lobbies	Elevator button, air supply inlets	0	8
		Entrance of 1402, 1602	Door handle and bell	0	2
		Bathrooms, 1802	Various surfaces	0	7
		Master bathroom, 2302	Various surfaces	0	8
		Guest bathroom, 2302	Various surfaces	0	6
	Feb 14 (55 samples)	Master bedroom, 2302	Door handle, light switch, and remote controller in the master bedroom	0	1
Master bathroom, 2502		Bathtub drain, exhaust fan	0	2	
Master bathroom, 2602		Various surfaces	0	14	
Guest bathroom, 2602		Various surfaces	0	7	

	Kitchen sink, 2602	Inner surface	0	1
	Bathroom, 2702	Various surfaces	0	9
Feb 19	Rooftop of -02 flats	End of vertical drainage stack	0	1
		Vent pipe of the wastewater pipe for the kitchen	0	1
	Master bathroom, 1502	Washbasin U-trap inner surface	1	1
Total			6	237

Supplement Table 5. Master Bathroom Usage Habits by Phone Survey of 16 Families

Living in -02 Flats (Excluding 1502)

	Use bathtub	Open window	Use exhaust fan	Wash floor using water	Notice sewer gas smell
Never	11*†	2*†	7†	12*†	13†
Occasionally	1	1	9*	3	3*
Often	4	13	0	1	0

*2502 Family included.

†2702 Family included.

Reviewing closed-circuit television camera records retrospectively, we found that Family A used the two elevators in Block X during January 25 through January 30, 2020, for 73 person-times. Only three residents in Block X shared the elevators with at least one Family A member, but none of them got infected. The exposure risk difference due to 30 min use exposure or 4 hr use exposure between the infected and non-infected families is not significant (Supplement Table 6).

Family A members wore masks while using the elevator for 69 out of the 73 person-times.

None of the residents who used the elevator within 30 min after an unmasked Family A member or members left became infected. Residents in Block X seldom touched the elevator button, as a resident card is used for the lift. No positive surface samples were detected in the two elevators.

Supplement Table 6. Exposure of Residents in Block X to Family A in Lifts*

Family	Shared-use exposure (person-times)	30 min use exposure (person-times per family)	4 hr use exposure (person-times per family)
Family B	0	3	9
Family C	0	16	34
Other 54 families	3	5.4	23.2

*Shared use exposure refers to sharing a lift with at least one Family A member; 30 min use exposure refers to a resident using an elevator within 30 min after its use by at least one Family A member; 4 hr use exposure refers to a resident using an elevator within 4 hr after its use by at least one Family A member.

References

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26. The Novel Coronavirus Pneumonia Emergency Response Epidemiology Team. Vital surveillances: the epidemiological characteristics of an outbreak of 2019 novel coronavirus diseases (Covid-19)—China, 2020. *China CDC Weekly* 2020;2(8):113-22.