Spatiotemporal Characteristics and Risk Factors of the COVID-19 Pandemic in New York State: Implication of Future Policies

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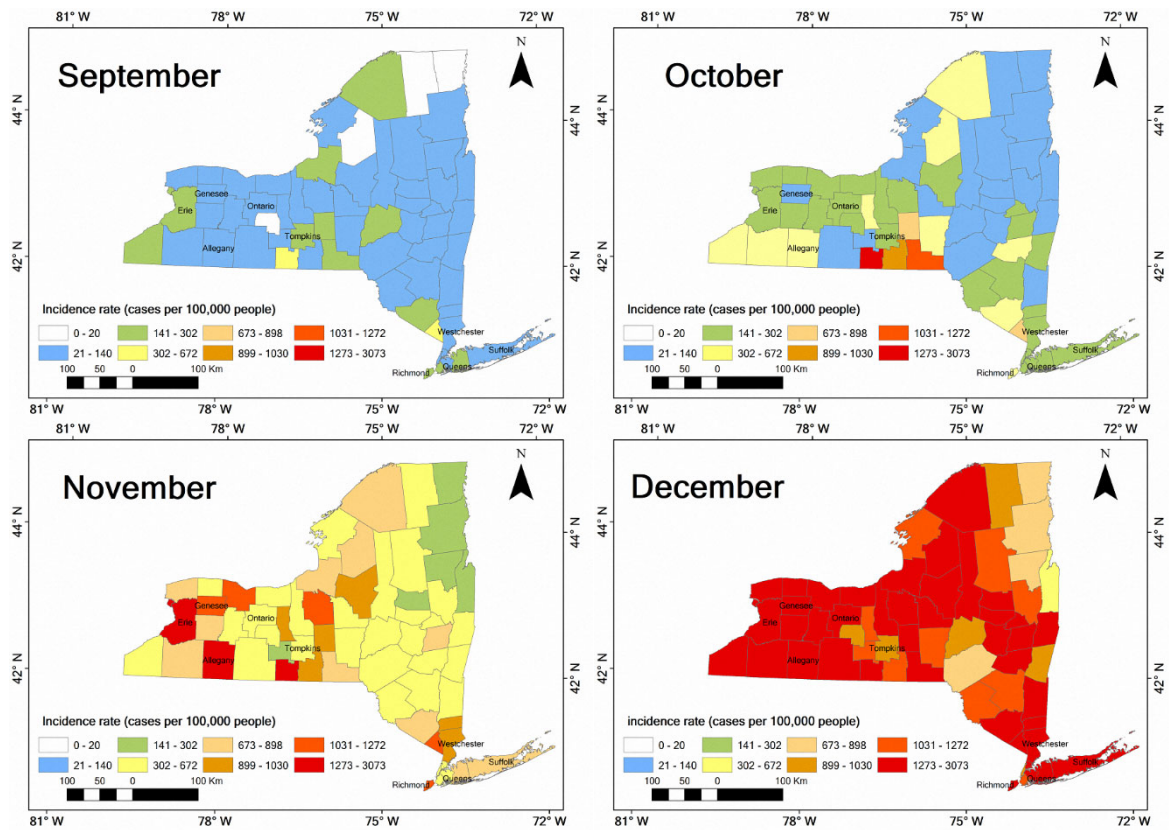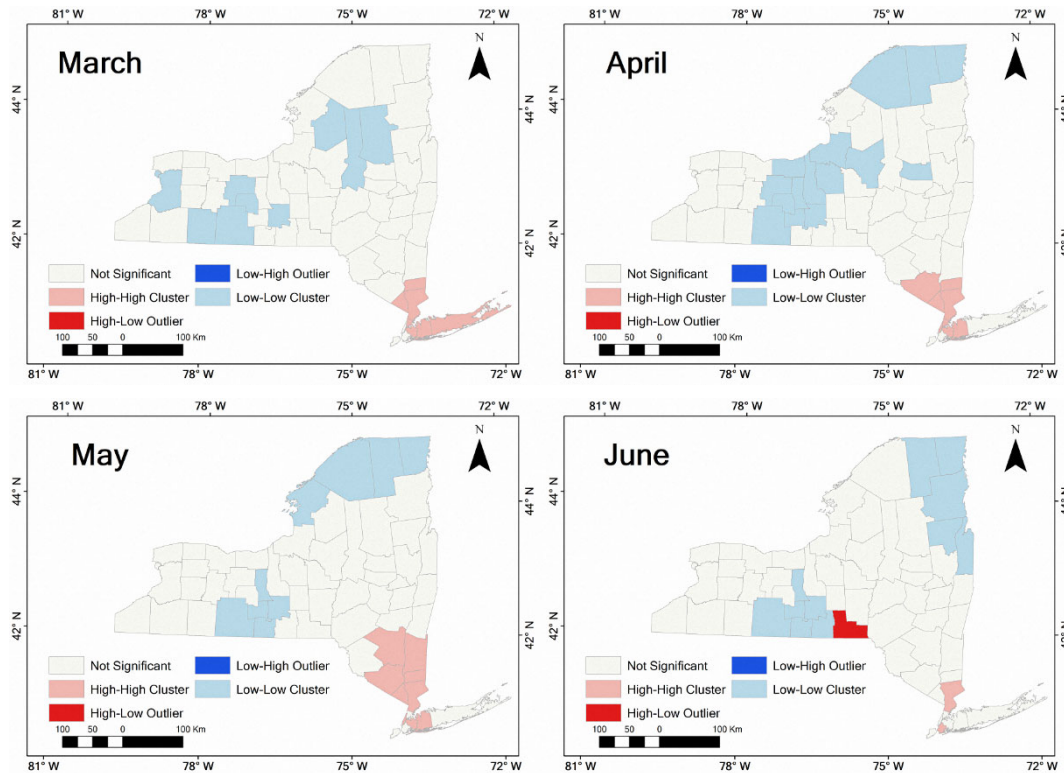
Supplementary Information
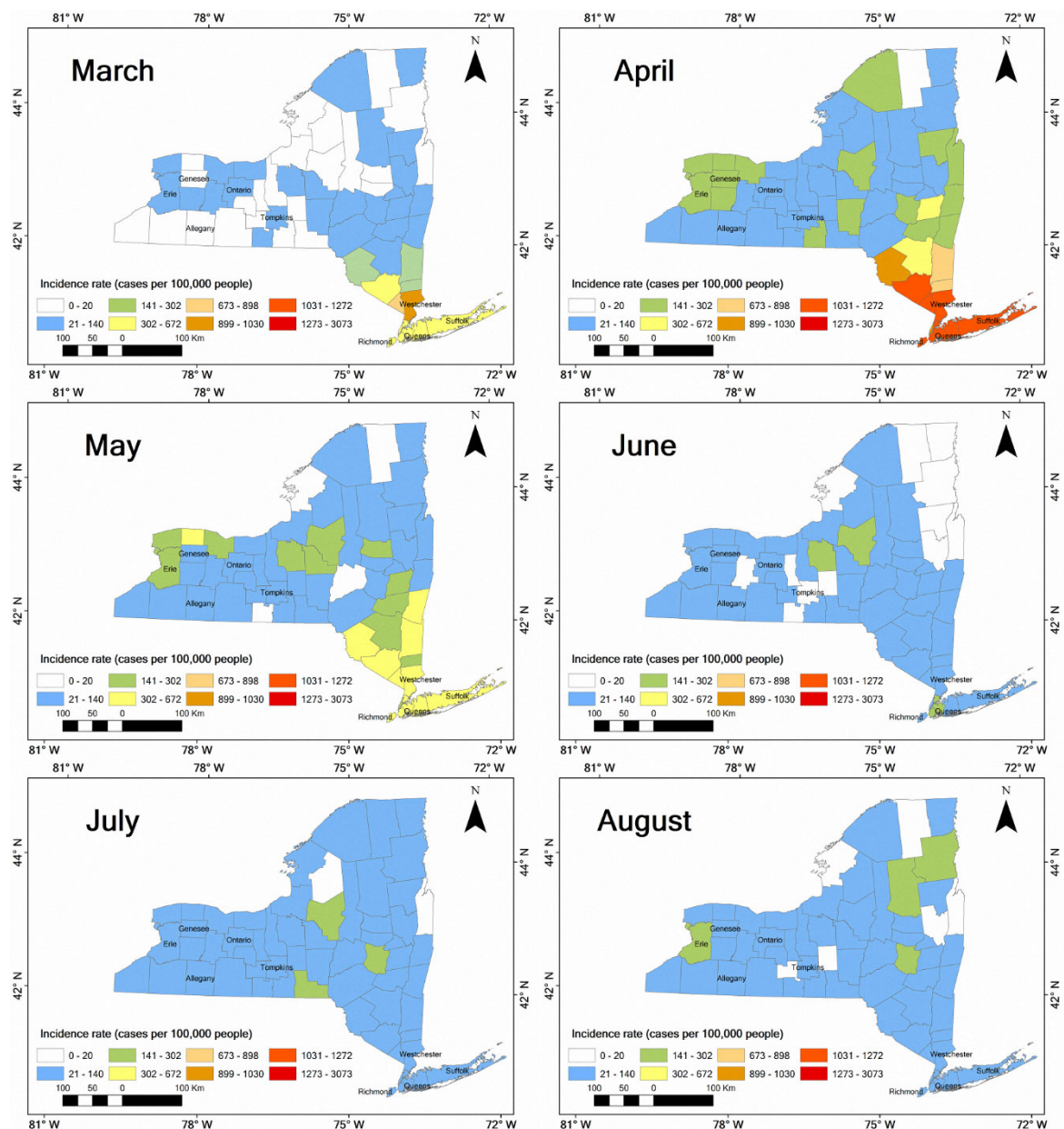
Figure S1. Distribution of Monthly Incidence of COVID-19 in New York State (March-December 2020).
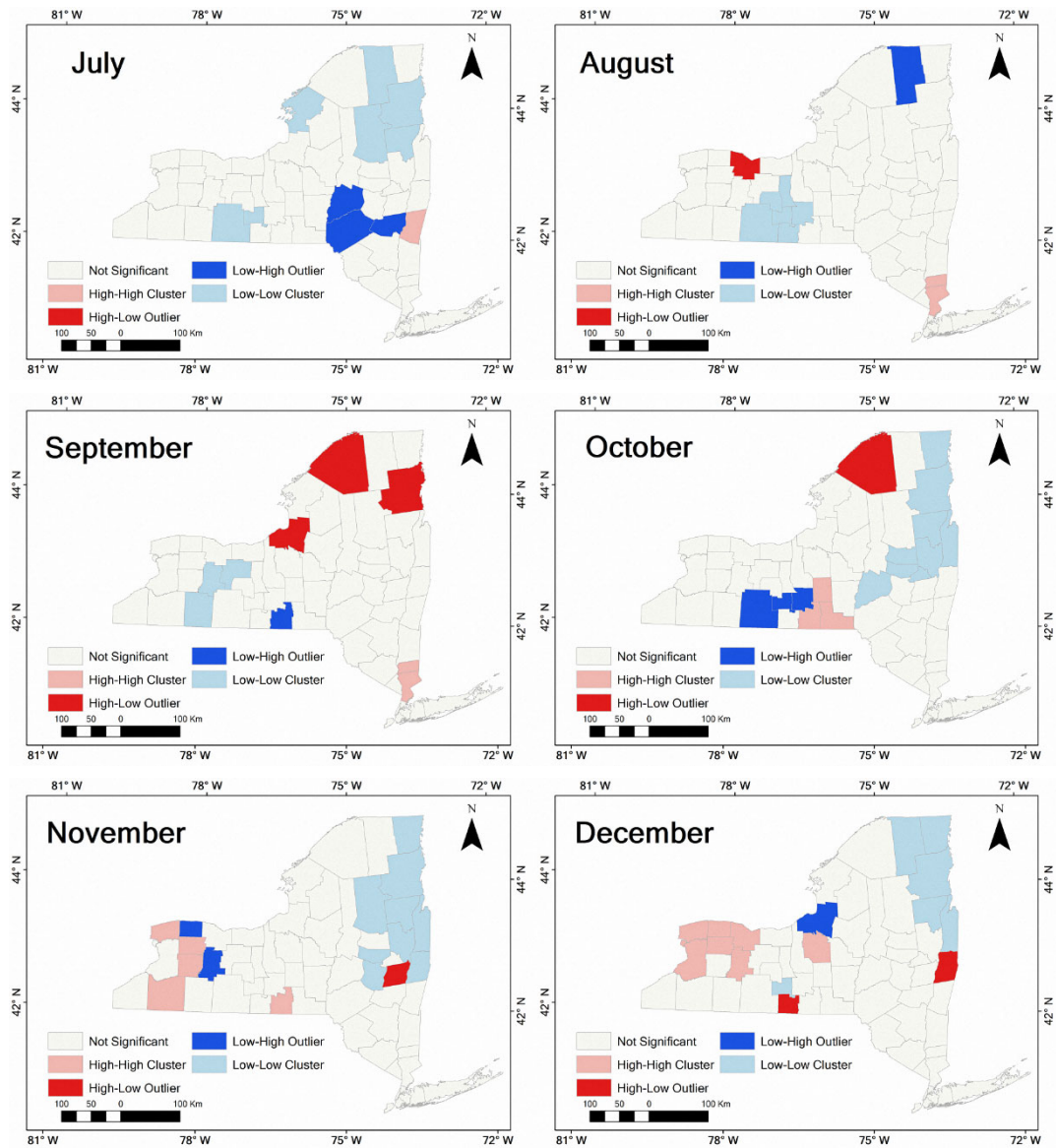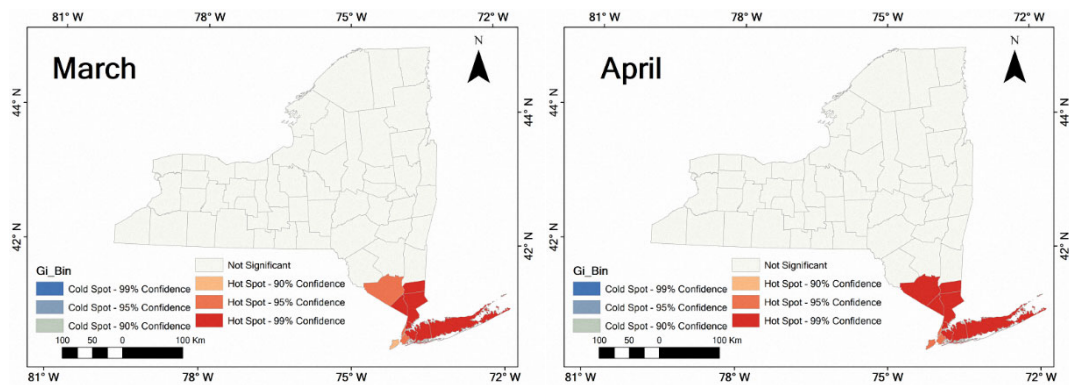
Figure S2. Cluster distribution of confirmed cases of COVID-19 in New York (March-December 2020).
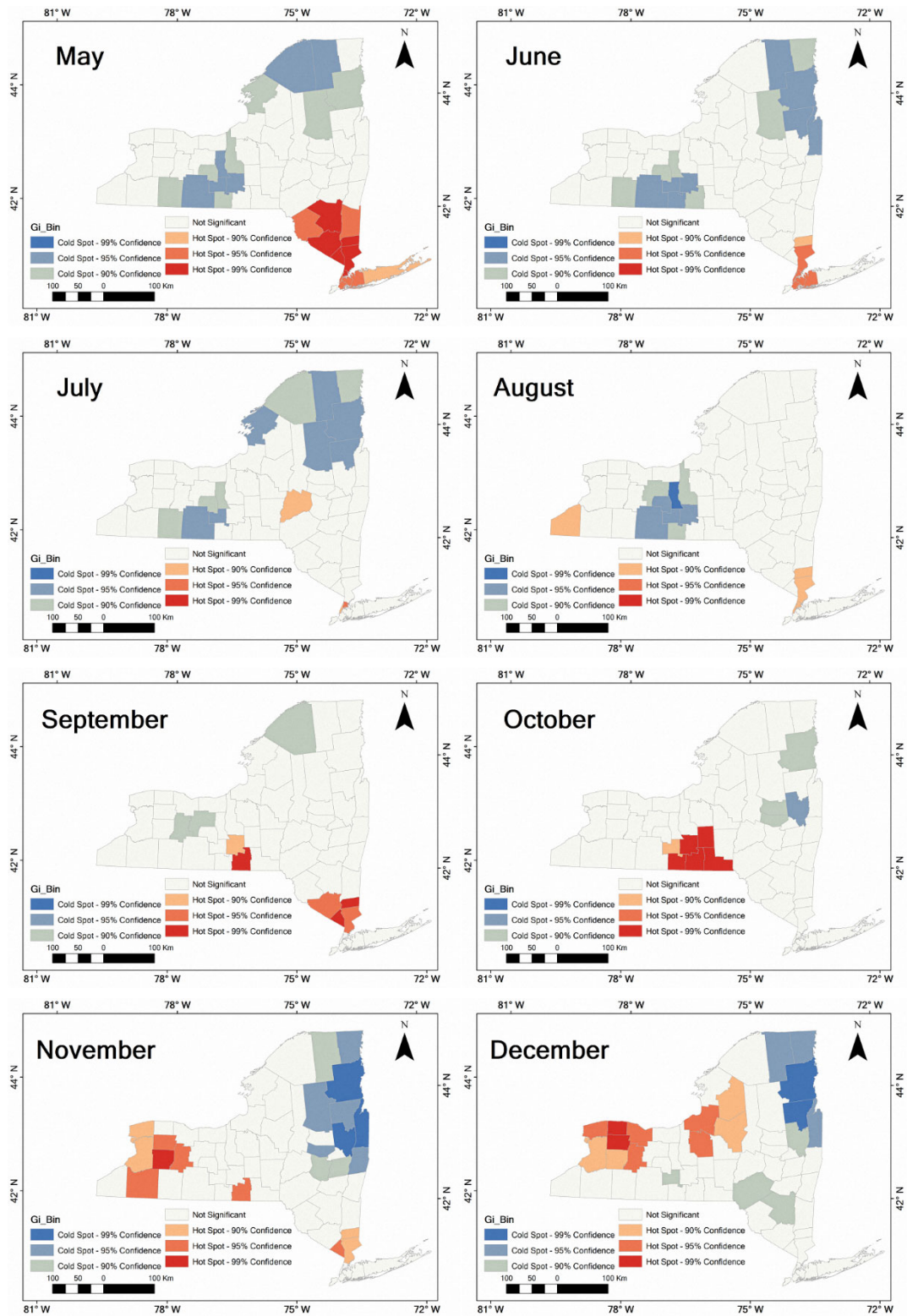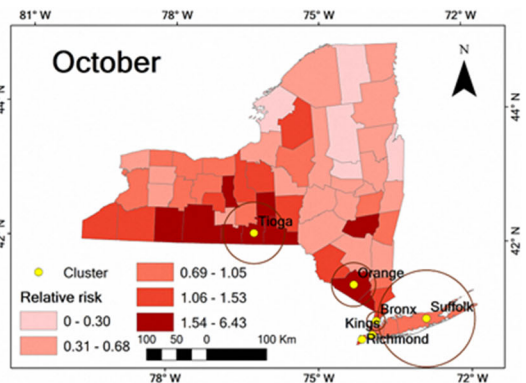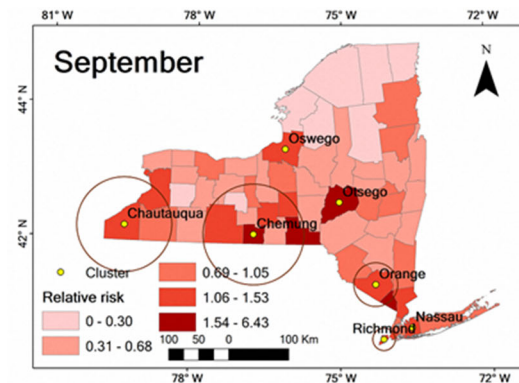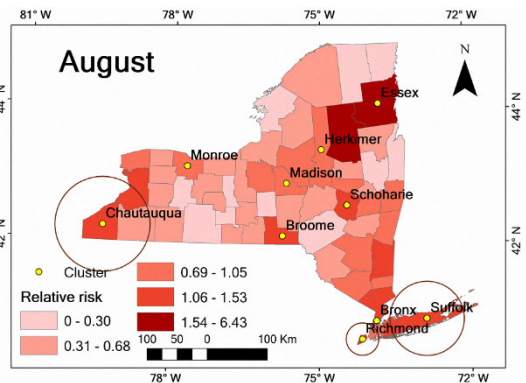
Figure S3. LISA cluster distribution map of the incidence of COVID-19 in New York State (March-December 2020).
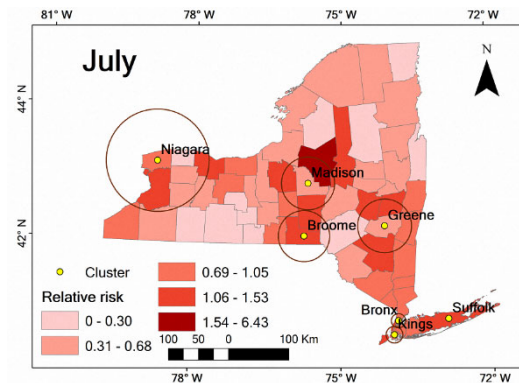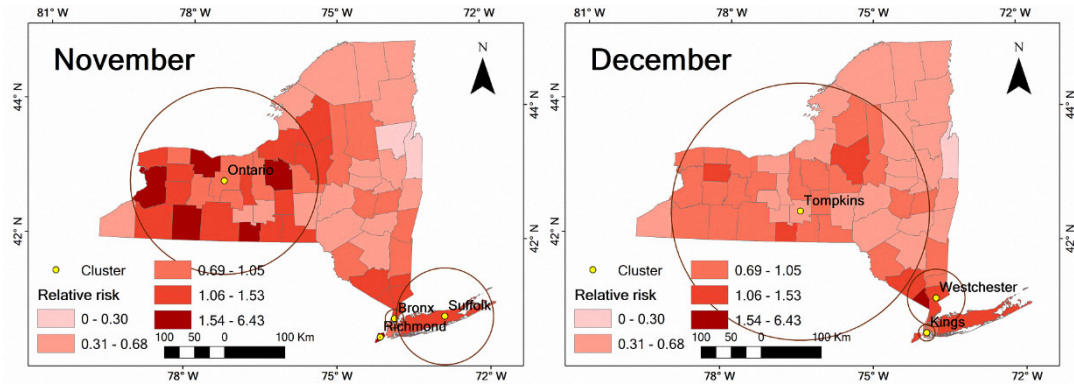
Figure S4. the COVID-19 spatiotemporal gathering area in 62 counties of New York State (March to December, 2020).

Table S1. Spatiotemporal scan statistics on the monthly cases.

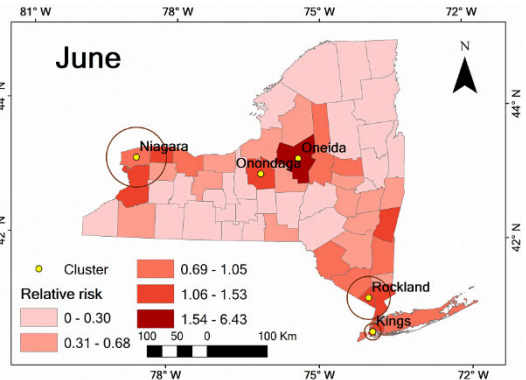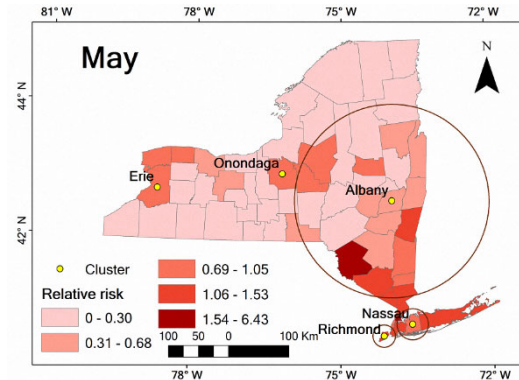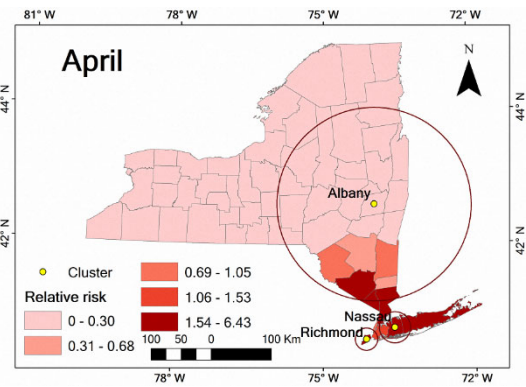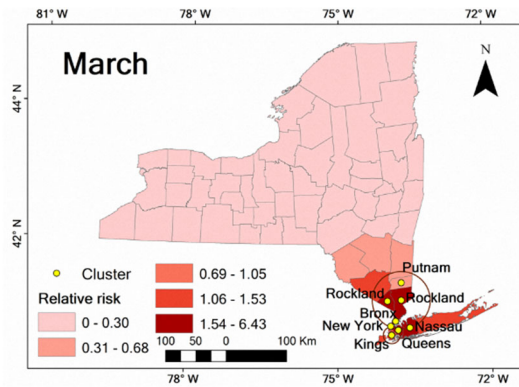| Month	Cluster class	Cluster center	Radius (Km)	Time	Observed	Expected	RR	LLR	P value
March	1	Westchester	47.73	2020/3/23 - 2020/3/31	28,166	6435.94	6.43	23,766.08	<0.001
	2	Kings	13.87	2020/3/23 - 2020/3/31	19,457	5345.76	4.57	12,576.53	<0.001
April	1	Nassau	25.88	2020/4/3 - 2020/4/11	37,603	17,835.50	2.32	9231.31	<0.001
	2	Richmond	18.57	2020/4/3 - 2020/4/11	16,991	10,767.45	1.62	1616.19	<0.001
	3	Albany	160.94	2020/4/2 - 2020/4/10	16,720	15,328.04	1.10	65.90	<0.001
May	1	Nassau	25.88	2020/5/1 - 2020/5/9	10,596	4983.30	2.34	2645.41	<0.001
	2	Richmond	18.57	2020/5/1 - 2020/5/9	5428	3008.47	1.88	830.52	<0.001
	3	Albany	160.94	2020/5/1 - 2020/5/7	4710	3331.00	1.45	267.81	<0.001
	4	Onondaga	0.00	2020/5/19 - 2020/5/25	461	354.93	1.30	14.55	<0.001
June	1	Kings	13.87	2020/6/1 - 2020/6/8	2482	1495.05	1.74	294.57	<0.001
	2	Rockland	35.68	2020/6/1 - 2020/6/7	1374	736.87	1.92	228.32	<0.001
	3	Oneida	0.00	2020/6/22 - 2020/6/29	223	71.02	3.16	103.69	<0.001
	4	Niagara	49.65	2020/6/1 - 2020/6/9	641	408.22	1.59	57.68	<0.001
	5	Onondaga	0.00	2020/6/1 - 2020/6/7	222	125.15	1.78	30.60	<0.001
July	1	Madison	43.94	2020/7/1 - 2020/7/9	449	245.64	1.85	68.43	<0.001
	2	Bronx	11.85	2020/7/16 - 2020/7/24	1359	984.60	1.41	66.98	<0.001
	3	Niagara	85.03	2020/7/9 - 2020/7/17	882	648.63	1.38	38.99	<0.001
	4	Greene	44.62	2020/7/23 - 2020/7/30	348	214.00	1.64	35.62	<0.001
	5	Suffolk	0.00	2020/7/9 - 2020/7/16	603	424.14	1.43	34.06	<0.001
	6	Broome	42.46	2020/7/20 - 2020/7/26	116	59.74	1.95	20.79	<0.001
August	1	Chautauqua	78.71	2020/8/25 - 2020/8/31	509	257.05	2.01	97.43	<0.001

	2	Bronx	0.00	2020/8/12 - 2020/8/19	629	371.42	1.72	75.50	<0.001
	3	Essex	0.00	2020/8/20 - 2020/8/28	63	10.87	5.81	58.65	<0.001
	4	Schoharie	0.00	2020/8/21 - 2020/8/29	112	45.76	2.46	34.13	<0.001
	5	Suffolk	61.66	2020/8/1 - 2020/8/8	950	742.07	1.29	27.88	<0.001
	6	Richmond	26.93	2020/8/10 - 2020/8/16	1285	1068.95	1.22	21.75	<0.001
	1	Orange	36.38	2020/9/22 - 2020/9/30	940	261.88	3.70	533.03	<0.001
	2	Richmond	18.57	2020/9/22 - 2020/9/30	1853	1118.67	1.71	212.78	<0.001
	3	Chemung	83.86	2020/9/24 - 2020/9/30	496	183.70	2.74	182.43	<0.001
September	4	Otsego	0.00	2020/9/1 - 2020/9/7	141	17.05	8.31	174.25	<0.001
	5	Chautauqua	78.71	2020/9/1 - 2020/9/7	555	321.46	1.74	70.70	<0.001
	6	Nassau	0.00	2020/9/11 - 2020/9/19	709	499.98	1.43	39.56	<0.001
	7	Oswego	0.00	2020/9/13 - 2020/9/21	94	43.16	2.18	22.39	<0.001
	1	Tioga	51.03	2020/10/20 - 2020/10/28	1473	344.35	4.38	1025.44	<0.001
	2	Orange	36.38	2020/10/1 - 2020/10/9	1752	518.61	3.47	915.28	<0.001
October	3	Richmond	0.00	2020/10/24 - 2020/10/31	606	308.83	1.97	112.24	<0.001
	4	Kings	0.00	2020/10/2 - 2020/10/10	2373	1867.93	1.28	65.57	<0.001
	5	Suffolk	80.46	2020/10/24 - 2020/10/31	3025	2465.39	1.24	62.57	<0.001
	1	Ontario	155.19	2020/11/21 - 2020/11/29	16775	8736.79	2.04	3155.36	<0.001
November	2	Suffolk	80.46	2020/11/22 - 2020/11/30	13921	8232.00	1.77	1748.87	<0.001
	3	Richmond	0.00	2020/11/22 - 2020/11/30	2225	1031.20	2.18	522.43	<0.001
	4	Bronx	15.41	2020/11/24 - 2020/11/30	9611	8928.91	1.08	27.19	<0.001
	1	Westchester	47.73	2020/12/25 - 2020/12/31	355,337	86,991.70	5.25	264,053.00	<0.001
December	2	Kings	13.87	2020/12/25 - 2020/12/31	260,954	72,256.19	4.27	161,797.51	<0.001
	3	Tompkins	213.86	2020/12/25 - 2020/12/31	254,828	87,330.33	3.39	117,608.06	<0.001

Table S2. Detection results of Geometrical interval.

	Index	Temperature	Precipitation	PM 2.5 concentration	Unemployment rate	Population mobility	Population Density
March	q	0.7776	0.3154	0.2011	0.3593	0.3897	0.5722
	p	0.000	0.0022	0.0344	0.000	0.000	0.000
April	q	0.7554	0.5006	0.2343	0.0187	0.2184	0.6086
	p	0.000	0.000	0.0156	0.8979	0.0190	0.000
May	q	0.4553	0.0963	0.5430	0.0963	0.2753	0.4739
	p	0.000	0.2722	0.000	0.2722	0.0095	0.000
June	q	0.3776	0.0575	0.3536	0.3236	0.1035	0.4356
	p	0.000	0.5206	0.0217	0.0196	0.2417	0.0032
July	q	0.2130	0.1037	0.1573	0.1850	0.0543	0.4204

Month	Index						
	p	0.0900	0.4240	0.1717	0.1910	0.8893	0.0095
August	q	0.3070	0.0533	0.0558	0.1681	0.1178	0.2991
	p	0.0316	0.5442	0.6144	0.2423	0.2403	0.0831
September	q	0.1169	0.1082	0.0095	0.1742	0.0401	0.1852
	p	0.2092	0.2081	0.9728	0.0727	0.6938	0.2167
October	q	0.1073	0.0623	0.0903	0.0410	0.1187	0.0261
	p	0.2672	0.4647	0.2824	0.6813	0.2186	0.8684
November	q	0.2575	0.1200	0.1068	0.1685	0.1823	0.1929
	p	0.0166	0.2401	0.3148	0.2272	0.0735	0.3934
December	q	0.1286	0.0339	0.1521	0.0507	0.1489	0.2587
	p	0.3868	0.7672	0.2564	0.8765	0.4276	0.3735

Table S3. Detection results of Equal interval.

	Index	Population Density	Temperature	Precipitation	PM 2.5 concentration	Unemployment rate	Population mobility
March	q	0.2055	0.7645	0.3207	0.2011	0.3045	0.4855
	p	0.5502	0.000	0.0024	0.0344	0.000	0.000
April	q	0.1936	0.8256	0.4155	0.2796	0.0303	0.3528
	p	0.5597	0.000	0.000	0.0035	0.7780	0.000
May	q	0.1880	0.4591	0.1298	0.5689	0.3224	0.2659
	p	0.7401	0.000	0.1554	0.000	0.1504	0.0420
June	q	0.1668	0.3776	0.0575	0.2921	0.3236	0.1134
	p	0.8570	0.000	0.5206	0.0781	0.0196	0.1699
July	q	0.0711	0.2130	0.1037	0.1573	0.1850	0.0543
	p	0.9914	0.0900	0.4240	0.1717	0.1910	0.8893
August	q	0.0620	0.1839	0.0578	0.0631	0.1540	0.0892
	p	0.9827	0.2100	0.5956	0.9344	0.8612	0.7767
September	q	0.0054	0.1679	0.0908	0.0869	0.0079	0.0360
	p	0.9944	0.2410	0.2985	0.6584	0.9926	0.6539
October	q	0.0041	0.1073	0.0911	0.0851	0.0029	0.1171
	p	0.9830	0.2672	0.2983	0.3344	0.9988	0.1468
November	q	0.2854	0.0728	0.0814	0.0100	0.1933	0.0093
	p	0.0259	0.6247	0.8979	0.9930	0.0307	0.9937
December	q	0.0558	0.0348	0.2655	0.1224	0.0270	0.0294
	p	0.9576	0.9278	0.1146	0.8157	0.9991	0.9912

Table S4. Interactive detection results.

Month	Impacting factors	Population Density	Unemployment rate	Temperature	Precipitation	PM 2.5 concentration	population mobility
March	Population Density	0.8167					
	Unemployment rate	0.8589	0.3321				
	Temperature	0.9590	0.7715	0.7645			
	Precipitation	0.9046	0.7451	0.8984	0.3746		
	PM 2.5 concentration	0.9046	0.7451	0.8984	0.3847	0.3746	
	population mobility	0.8300	0.5313	0.8903	0.5950	0.5950	0.3152
April	Population Density	0.7012					
	Unemployment rate	0.7213	0.0322				
	Temperature	0.9027	0.8613	0.8260			
	Precipitation	0.8440	0.7840	0.9142	0.6195		
	PM 2.5 concentration	0.7949	0.5346	0.8553	0.7533	0.3764	
	population mobility	0.7724	0.5757	0.8619	0.9426	0.8549	0.4343

Month	Variable						
May	Population Density	0.3889					
	Unemployment rate	0.5874	0.2465				
	Temperature	0.5777	0.6698	0.4551			
	Precipitation	0.5595	0.5857	0.5616	0.0842		
	PM 2.5 concentration	0.6723	0.6472	0.7451	0.6334	0.5281	
	population mobility	0.5327	0.4909	0.6106	0.4573	0.7105	0.1939
June	Population Density	0.4171					
	Unemployment rate	0.6001	0.3013				
	Temperature	0.5275	0.5363	0.3240			
	Precipitation	0.6824	0.4888	0.7401	0.0429		
	PM 2.5 concentration	0.7416	0.7963	0.7079	0.4764	0.3018	
	population mobility	0.4413	0.6193	0.5350	0.3958	0.4413	0.1663
July	Population Density	0.4734					
	Unemployment rate	0.5590	0.2266				
	Temperature	0.6209	0.3728	0.2485			
	Precipitation	0.7257	0.4750	0.5114	0.1203		
	PM 2.5 concentration	0.6954	0.4898	0.3834	0.3715	0.0942	
	population mobility	0.5651	0.4603	0.6190	0.5680	0.3010	0.1453
August	Population Density	0.5185					
	Unemployment rate	0.3111	0.2597				
	Temperature	0.4939	0.4491	0.1746			
	Precipitation	0.4352	0.4647	0.3375	0.0237		
	PM 2.5 concentration	0.7737	0.6243	0.5798	0.4274	0.5798	
	population mobility	0.6619	0.6284	0.4467	0.3825	0.4757	0.1347
September	Population Density	0.2193					
	Unemployment rate	0.4568	0.2168				
	Temperature	0.3206	0.4609	0.1320			
	Precipitation	0.5199	0.5685	0.2578	0.1059		
	PM 2.5 concentration	0.3943	0.3868	0.2690	0.3711	0.0522	
	population mobility	0.5880	0.4767	0.3019	0.4307	0.3013	0.1302
October	Population Density	0.0200					
	Unemployment rate	0.0675	0.0426				
	Temperature	0.1359	0.1544	0.1000			
	Precipitation	0.1427	0.1741	0.2864	0.0940		
	PM 2.5 concentration	0.1446	0.1690	0.2552	0.3832	0.0858	
	population mobility	0.1646	0.1901	0.2898	0.3008	0.3177	0.0684
November	Population Density	0.1681					

	Unemployment rate	0.3058	0.0977			
	Temperature	0.5517	0.4594	0.2887		
	Precipitation	0.3646	0.3861	0.5239	0.0698	
	PM 2.5 concentration	0.4859	0.4089	0.6194	0.5364	0.1182
	population mobility	0.5378	0.4263	0.6015	0.5064	0.4410	0.1565
	Population Density	0.2008				
	Unemployment rate	0.4129	0.1156			
December	Temperature	0.4000	0.4845	0.5224		
	Precipitation	0.5157	0.5152	0.5189	0.1105	
	PM 2.5 concentration	0.4888	0.5029	0.4886	0.4875	0.1683
	population mobility	0.4643	0.2924	0.5152	0.4742	0.4113	0.1532

■ represents q > 0.9; ■ represents q > 0.8; ■ represents q > 0.7.