SUPPLEMENTARY MATERIALS FOR

COVID-19 SEROPOSITIVITY ACROSS SOCIODEMOGRAPHIC AND GEOGRAPHIC SUBGROUPS OF CANADIAN BLOOD DONORS THROUGH THE OMICRON PERIOD

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SUPPLEMENTARY TABLES

Table S1: *Distribution of individual and neighborhood characteristics for donations tested during the Pre-Delta wave. For social and material deprivation quintile, 1 is the lowest level of neighborhood deprivation and 5 is the highest level.*[1]

Level	Overall	Atlantic	BC	Ontario	Prairies
n	89710	10269	14068	39069	26304
Mean Seropositivity	0.036	0.004	0.029	0.033	0.049
Sex (%)					
Female	38916 (43.4)	4470 (43.5)	6130 (43.6)	17154 (43.9)	11162 (42.4)
Male	50794 (56.6)	5799 (56.5)	7938 (56.4)	21915 (56.1)	15142 (57.6)
Age Group (%)					
16-24	6404 (7.1)	563 (5.5)	874 (6.2)	3001 (7.7)	1966 (7.5)
25-34	16996 (18.9)	1529 (14.9)	2953 (21.0)	7661 (19.6)	4853 (18.4)
35-44	15316 (17.1)	1568 (15.3)	2541 (18.1)	6477 (16.6)	4730 (18.0)
45-54	15277 (17.0)	1832 (17.8)	2293 (16.3)	6854 (17.5)	4298 (16.3)
55-64	20113 (22.4)	2606 (25.4)	2909 (20.7)	8764 (22.4)	5834 (22.2)
65-74	13170 (14.7)	1811 (17.6)	2041 (14.5)	5387 (13.8)	3931 (14.9)
75+	2434 (2.7)	360 (3.5)	457 (3.2)	925 (2.4)	692 (2.6)
Race (%)					
Minority	14931 (16.6)	624 (6.1)	3435 (24.4)	6847 (17.5)	4025 (15.3)
White	74779 (83.4)	9645 (93.9)	10633 (75.6)	32222 (82.5)	22279 (84.7)
Social Deprivation Quintile (%)					
1	18355 (20.5)	1304 (12.7)	2523 (17.9)	8794 (22.5)	5734 (21.8)
2	19034 (21.2)	2689 (26.2)	2981 (21.2)	8600 (22.0)	4764 (18.1)
3	18107 (20.2)	2669 (26.0)	2695 (19.2)	7604 (19.5)	5139 (19.5)
4	16696 (18.6)	2018 (19.7)	2560 (18.2)	6898 (17.7)	5220 (19.8)
5	17518 (19.5)	1589 (15.5)	3309 (23.5)	7173 (18.4)	5447 (20.7)
Material Deprivation Quintile (%)					
1	27518 (30.7)	1856 (18.1)	4302 (30.6)	10416 (26.7)	10944 (41.6)
2	21636 (24.1)	2138 (20.8)	3602 (25.6)	9488 (24.3)	6408 (24.4)
3	18217 (20.3)	2096 (20.4)	2874 (20.4)	8653 (22.1)	4594 (17.5)
4	14116 (15.7)	2360 (23.0)	2075 (14.7)	6681 (17.1)	3000 (11.4)
5	8223 (9.2)	1819 (17.7)	1215 (8.6)	3831 (9.8)	1358 (5.2)
Urban (%)					
Rural	11591 (12.9)	2001 (19.5)	603 (4.3)	5948 (15.2)	3039 (11.6)
Urban	78119 (87.1)	8268 (80.5)	13465 (95.7)	33121 (84.8)	23265 (88.4)

[1] BC: British Columbia; Level: Different demographic variable groups

Table S2: *Distribution of individual and neighborhood characteristics for donations tested during the Delta wave. For social and material deprivation quintile, 1 is the lowest level of neighborhood deprivation and 5 is the highest level.*[1]

Level	Overall	Atlantic	BC	Ontario	Prairies
n	30309	4157	4917	10119	11116
Mean Seropositivity	0.047	0.007	0.047	0.039	0.070
Sex (%)					
Female	11943 (39.4)	1743 (41.9)	1999 (40.7)	3902 (38.6)	4299 (38.7)
Male	18366 (60.6)	2414 (58.1)	2918 (59.3)	6217 (61.4)	6817 (61.3)
Age Group (%)					
16-24	3007 (9.9)	312 (7.5)	543 (11.0)	955 (9.4)	1197 (10.8)
25-34	5180 (17.1)	705 (17.0)	955 (19.4)	1645 (16.3)	1875 (16.9)
35-44	4706 (15.5)	665 (16.0)	828 (16.8)	1442 (14.3)	1771 (15.9)
45-54	4653 (15.4)	652 (15.7)	700 (14.2)	1749 (17.3)	1552 (14.0)
55-64	6746 (22.3)	969 (23.3)	992 (20.2)	2310 (22.8)	2475 (22.3)
65-74	5076 (16.7)	706 (17.0)	735 (14.9)	1715 (16.9)	1920 (17.3)
75+	941 (3.1)	148 (3.6)	164 (3.3)	303 (3.0)	326 (2.9)
Race (%)					
Minority	4679 (15.4)	280 (6.7)	1133 (23.0)	1627 (16.1)	1639 (14.7)
White	25630 (84.6)	3877 (93.3)	3784 (77.0)	8492 (83.9)	9477 (85.3)
Social Deprivation Quintile (%)					
1	6401 (21.1)	530 (12.7)	971 (19.7)	2333 (23.1)	2567 (23.1)
2	6311 (20.8)	1023 (24.6)	982 (20.0)	2366 (23.4)	1940 (17.5)
3	6124 (20.2)	1034 (24.9)	947 (19.3)	1938 (19.2)	2205 (19.8)
4	5729 (18.9)	870 (20.9)	841 (17.1)	1750 (17.3)	2268 (20.4)
5	5744 (19.0)	700 (16.8)	1176 (23.9)	1732 (17.1)	2136 (19.2)
Material Deprivation Quintile (%)					
1	9655 (31.9)	772 (18.6)	1556 (31.6)	2748 (27.2)	4579 (41.2)
2	7474 (24.7)	936 (22.5)	1281 (26.1)	2612 (25.8)	2645 (23.8)
3	5866 (19.4)	869 (20.9)	944 (19.2)	2149 (21.2)	1904 (17.1)
4	4710 (15.5)	921 (22.2)	725 (14.7)	1685 (16.7)	1379 (12.4)
5	2604 (8.6)	659 (15.9)	411 (8.4)	925 (9.1)	609 (5.5)
Urban (%)					
Rural	3861 (12.7)	745 (17.9)	156 (3.2)	1625 (16.1)	1335 (12.0)
Urban	26448 (87.3)	3412 (82.1)	4761 (96.8)	8494 (83.9)	9781 (88.0)

[1] BC: British Columbia; Level: Different demographic variable groups

Table S3: *Distribution of individual and neighborhood characteristics for donations tested during the Omicron wave. For social and material deprivation quintile, 1 is the lowest level of neighborhood deprivation and 5 is the highest level.*[1]

Level	Overall	Atlantic	BC	Ontario	Prairies
n	300300	29572	48607	137557	84564
Mean Seropositivity	0.444	0.372	0.447	0.432	0.487
Sex (%)					
Female	130000 (43.3)	13384 (45.3)	21460 (44.2)	59295 (43.1)	35861 (42.4)
Male	170300 (56.7)	16188 (54.7)	27147 (55.8)	78262 (56.9)	48703 (57.6)
Age Group (%)					
16-24	22572 (7.5)	1931 (6.5)	3222 (6.6)	10531 (7.7)	6888 (8.1)
25-34	51388 (17.1)	4052 (13.7)	8617 (17.7)	24196 (17.6)	14523 (17.2)
35-44	51812 (17.3)	4442 (15.0)	8624 (17.7)	23393 (17.0)	15353 (18.2)
45-54	53764 (17.9)	5475 (18.5)	8494 (17.5)	25297 (18.4)	14498 (17.1)
55-64	69187 (23.0)	7652 (25.9)	10567 (21.7)	31864 (23.2)	19104 (22.6)
65-74	43781 (14.6)	5099 (17.2)	7518 (15.5)	18988 (13.8)	12176 (14.4)
75+	7796 (2.6)	921 (3.1)	1565 (3.2)	3288 (2.4)	2022 (2.4)
Race (%)					
Minority	51325 (17.1)	1977 (6.7)	11885 (24.5)	24689 (17.9)	12774 (15.1)
White	248975 (82.9)	27595 (93.3)	36722 (75.5)	112868 (82.1)	71790 (84.9)
Social Deprivation Quintile (%)					
1	64634 (21.5)	3632 (12.3)	9365 (19.3)	32121 (23.4)	19516 (23.1)
2	63823 (21.3)	7106 (24.0)	10510 (21.6)	30637 (22.3)	15570 (18.4)
3	59988 (20.0)	7677 (26.0)	9507 (19.6)	26477 (19.2)	16327 (19.3)
4	55797 (18.6)	6223 (21.0)	8488 (17.5)	23804 (17.3)	17282 (20.4)
5	56058 (18.7)	4934 (16.7)	10737 (22.1)	24518 (17.8)	15869 (18.8)
Material Deprivation Quintile (%)					
1	88921 (29.6)	5126 (17.3)	13917 (28.6)	35904 (26.1)	33974 (40.2)
2	74204 (24.7)	6747 (22.8)	13076 (26.9)	33795 (24.6)	20586 (24.3)
3	61612 (20.5)	6180 (20.9)	9966 (20.5)	30221 (22.0)	15245 (18.0)
4	47710 (15.9)	6649 (22.5)	7451 (15.3)	23702 (17.2)	9908 (11.7)
5	27853 (9.3)	4870 (16.5)	4197 (8.6)	13935 (10.1)	4851 (5.7)
Urban (%)					
Rural	40171 (13.4)	5059 (17.1)	2358 (4.9)	22278 (16.2)	10476 (12.4)
Urban	260129 (86.6)	24513 (82.9)	46249 (95.1)	115279 (83.8)	74088 (87.6)

[1] BC: British Columbia; Level: Different demographic variable groups

Table S4: *Number of donations sampled by month, region, and age group four months before and after the sampling strategy has been changed. A June 2021 switch from total random sampling to age- and region- stratified random sampling was intended to improve better representation of age groups that are less represented among blood donors, and to improve statistical power for regions with fewer blood donors (e.g., the Atlantic regions and young donors aged before 24). The age distribution appears to have shifted slightly with an increase in representation among the 16-24 age group. Tables S1 to S3 show the number of samples by wave. In the pre-delta wave 89,710 samples were tested (average 3738 per week); in the Delta wave 30,309 samples were tested (average 2755 per week), and in the Omicron wave 300,303 samples were tested (average 5888 per week).* [1]

A. Simple Random Sampling 2021 March-June

Month	Age.Group	Overall	Atlantic	BC	Ontario	Prairies
2021-Mar						
total		13550	1432	1984	6504	3630
	16-24	915 (6.8)	85 (5.9)	111 (5.6)	451 (6.9)	268 (7.4)
	25-34	2600 (19.2)	210 (14.7)	429 (21.6)	1264 (19.4)	697 (19.2)
	35-44	2226 (16.4)	211 (14.7)	348 (17.5)	1039 (16.0)	628 (17.3)
	45-54	2353 (17.4)	244 (17.0)	312 (15.7)	1175 (18.1)	622 (17.1)
	55-64	3053 (22.5)	347 (24.2)	410 (20.7)	1511 (23.2)	785 (21.6)
	65-74	2025 (14.9)	291 (20.3)	307 (15.5)	901 (13.9)	526 (14.5)
	75+	378 (2.8)	44 (3.1)	67 (3.4)	163 (2.5)	104 (2.9)
2021-Apr						
total		13821	1736	1743	6492	3850
	16-24	965 (7.0)	102 (5.9)	114 (6.5)	472 (7.3)	277 (7.2)
	25-34	2653 (19.2)	259 (14.9)	346 (19.9)	1328 (20.5)	720 (18.7)
	35-44	2403 (17.4)	270 (15.6)	340 (19.5)	1088 (16.8)	705 (18.3)
	45-54	2438 (17.6)	333 (19.2)	305 (17.5)	1151 (17.7)	649 (16.9)
	55-64	3080 (22.3)	449 (25.9)	382 (21.9)	1411 (21.7)	838 (21.8)
	65-74	1905 (13.8)	255 (14.7)	204 (11.7)	885 (13.6)	561 (14.6)
	75+	377 (2.7)	68 (3.9)	52 (3.0)	157 (2.4)	100 (2.6)
2021-May						
total		13745	1394	2043	6650	3658
	16-24	979 (7.1)	80 (5.7)	131 (6.4)	536 (8.1)	232 (6.3)
	25-34	2597 (18.9)	196 (14.1)	444 (21.7)	1281 (19.3)	676 (18.5)
	35-44	2312 (16.8)	201 (14.4)	372 (18.2)	1093 (16.4)	646 (17.7)
	45-54	2394 (17.4)	272 (19.5)	329 (16.1)	1168 (17.6)	625 (17.1)
	55-64	3138 (22.8)	349 (25.0)	440 (21.5)	1489 (22.4)	860 (23.5)
	65-74	1953 (14.2)	248 (17.8)	259 (12.7)	912 (13.7)	534 (14.6)
	75+	372 (2.7)	48 (3.4)	68 (3.3)	171 (2.6)	85 (2.3)
2021-Jun						
total		13680	1498	2088	5856	4238
	16-24	1004 (7.3)	90 (6.0)	124 (5.9)	454 (7.8)	336 (7.9)
	25-34	2508 (18.3)	230 (15.4)	427 (20.5)	1110 (19.0)	741 (17.5)
	35-44	2384 (17.4)	216 (14.4)	374 (17.9)	1015 (17.3)	779 (18.4)
	45-54	2374 (17.4)	282 (18.8)	364 (17.4)	1032 (17.6)	696 (16.4)
	55-64	3085 (22.6)	383 (25.6)	422 (20.2)	1313 (22.4)	967 (22.8)
	65-74	1966 (14.4)	240 (16.0)	309 (14.8)	805 (13.7)	612 (14.4)
	75+	359 (2.6)	57 (3.8)	68 (3.3)	127 (2.2)	107 (2.5)

B. Stratified Sampling (July-October, 2021)

Month	Age.Group	Overall	Atlantic	BC	Ontario	Prairies
2021-Jul						
total		6842	1092	1247	2087	2416
	16-24	726 (10.6)	56 (5.1)	122 (9.8)	285 (13.7)	263 (10.9)
	25-34	1324 (19.4)	184 (16.8)	263 (21.1)	429 (20.6)	448 (18.5)
	35-44	1158 (16.9)	173 (15.8)	215 (17.2)	348 (16.7)	422 (17.5)
	45-54	905 (13.2)	178 (16.3)	162 (13.0)	255 (12.2)	310 (12.8)
	55-64	1411 (20.6)	270 (24.7)	238 (19.1)	393 (18.8)	510 (21.1)
	65-74	1130 (16.5)	197 (18.0)	204 (16.4)	325 (15.6)	404 (16.7)
	75+	188 (2.7)	34 (3.1)	43 (3.4)	52 (2.5)	59 (2.4)
2021-Aug						
total		7429	939	1187	2565	2738
	16-24	714 (9.6)	61 (6.5)	141 (11.9)	239 (9.3)	273 (10.0)
	25-34	1293 (17.4)	172 (18.3)	235 (19.8)	421 (16.4)	465 (17.0)
	35-44	1166 (15.7)	148 (15.8)	194 (16.3)	394 (15.4)	430 (15.7)
	45-54	1122 (15.1)	150 (16.0)	169 (14.2)	451 (17.6)	352 (12.9)
	55-64	1690 (22.7)	221 (23.5)	234 (19.7)	594 (23.2)	641 (23.4)
	65-74	1238 (16.7)	155 (16.5)	181 (15.2)	397 (15.5)	505 (18.4)
	75+	206 (2.8)	32 (3.4)	33 (2.8)	69 (2.7)	72 (2.6)
2021-Sep						
total		7698	1062	1321	2611	2704
	16-24	716 (9.3)	66 (6.2)	127 (9.6)	232 (8.9)	291 (10.8)
	25-34	1296 (16.8)	179 (16.9)	232 (17.6)	424 (16.2)	461 (17.0)
	35-44	1184 (15.4)	171 (16.1)	225 (17.0)	355 (13.6)	433 (16.0)
	45-54	1224 (15.9)	173 (16.3)	187 (14.2)	469 (18.0)	395 (14.6)
	55-64	1710 (22.2)	232 (21.8)	301 (22.8)	587 (22.5)	590 (21.8)
	65-74	1308 (17.0)	201 (18.9)	203 (15.4)	461 (17.7)	443 (16.4)
	75+	260 (3.4)	40 (3.8)	46 (3.5)	83 (3.2)	91 (3.4)
2021-Oct						
total		7775	1066	1245	2625	2839
	16-24	840 (10.8)	124 (11.6)	153 (12.3)	252 (9.6)	311 (11.0)
	25-34	1281 (16.5)	185 (17.4)	255 (20.5)	393 (15.0)	448 (15.8)
	35-44	1261 (16.2)	159 (14.9)	215 (17.3)	403 (15.4)	484 (17.0)
	45-54	1152 (14.8)	153 (14.4)	177 (14.2)	426 (16.2)	396 (13.9)
	55-64	1726 (22.2)	251 (23.5)	229 (18.4)	604 (23.0)	642 (22.6)
	65-74	1272 (16.4)	156 (14.6)	169 (13.6)	464 (17.7)	483 (17.0)
	75+	243 (3.1)	38 (3.6)	47 (3.8)	83 (3.2)	75 (2.6)

[1] BC: British Columbia

SUPPLEMENTARY FIGURES

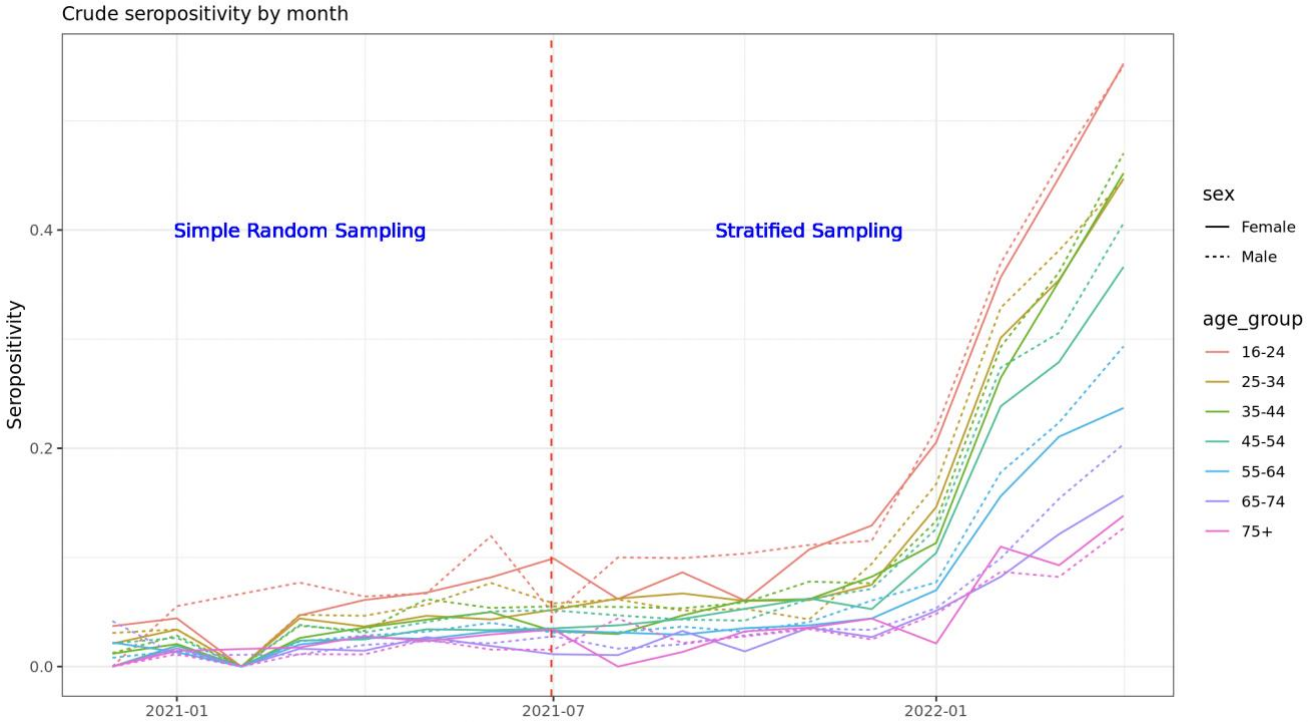

Figure S1: *Monthly seropositivity for different sex and age groups shows that the seropositivity does not have an obviously effect the trend line before and after the sampling scheme was changed.*

Note: the zero seropositivity in February of 2021 is caused by the truth that few sample is collected during that month.

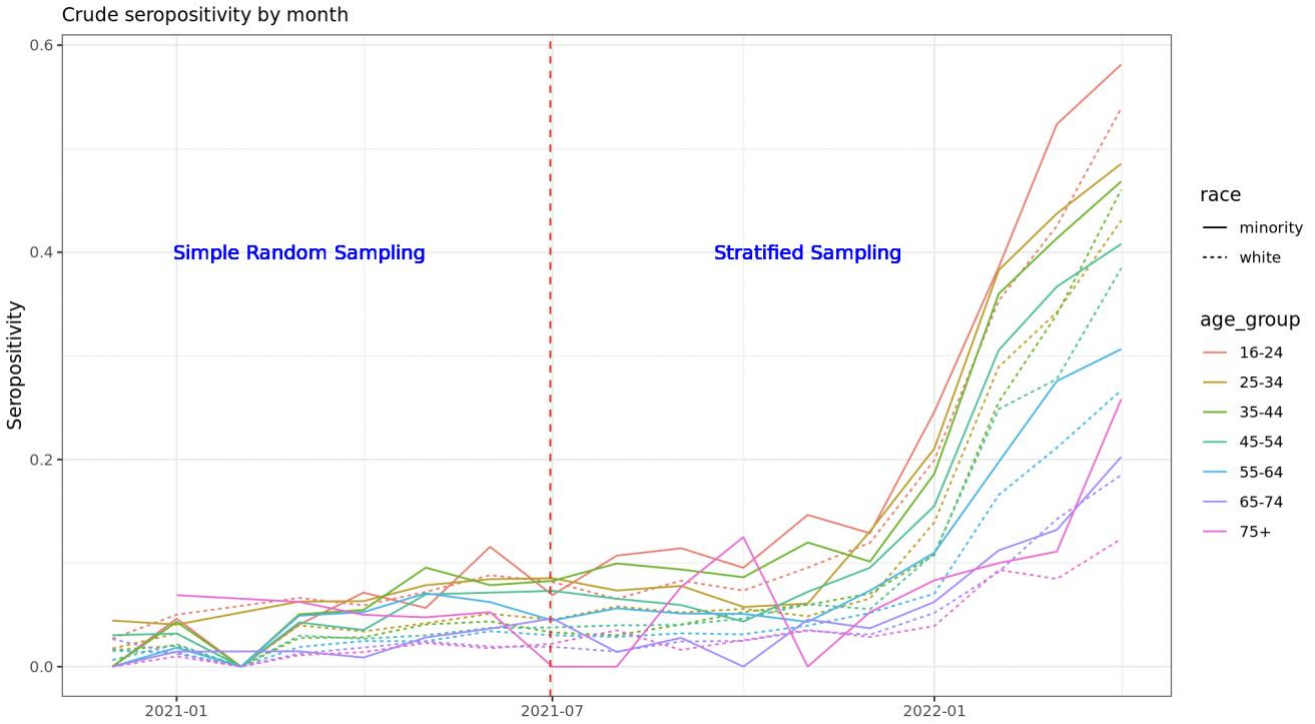

Figure S2: *Monthly seropositivity for different race and age groups shows that the seropositivity does not have an obviously effect the trend line before and after the sampling scheme was changed. Note: the zero seropositivity in February of 2021 is caused by the truth that few sample is collected during that month.*

Figure S3: *Seropositivity estimation of Ontario and British Columbia (BC), Prairies and Atlantic during Pre-Delta period through multilevel model with/without spatial random effect. Specifically, 39 out of 44 census divisions for Ontario, 19 out of 24 for BC, 37 out of 47 for Prairies and 25 out of 42 for Atlantic obtain more accurate estimate from multi-level models with spatial effect (MLM spatial) compared to generalized linear models (GLM). Observed seropositivity (Obs) is also presented for a comparison.*

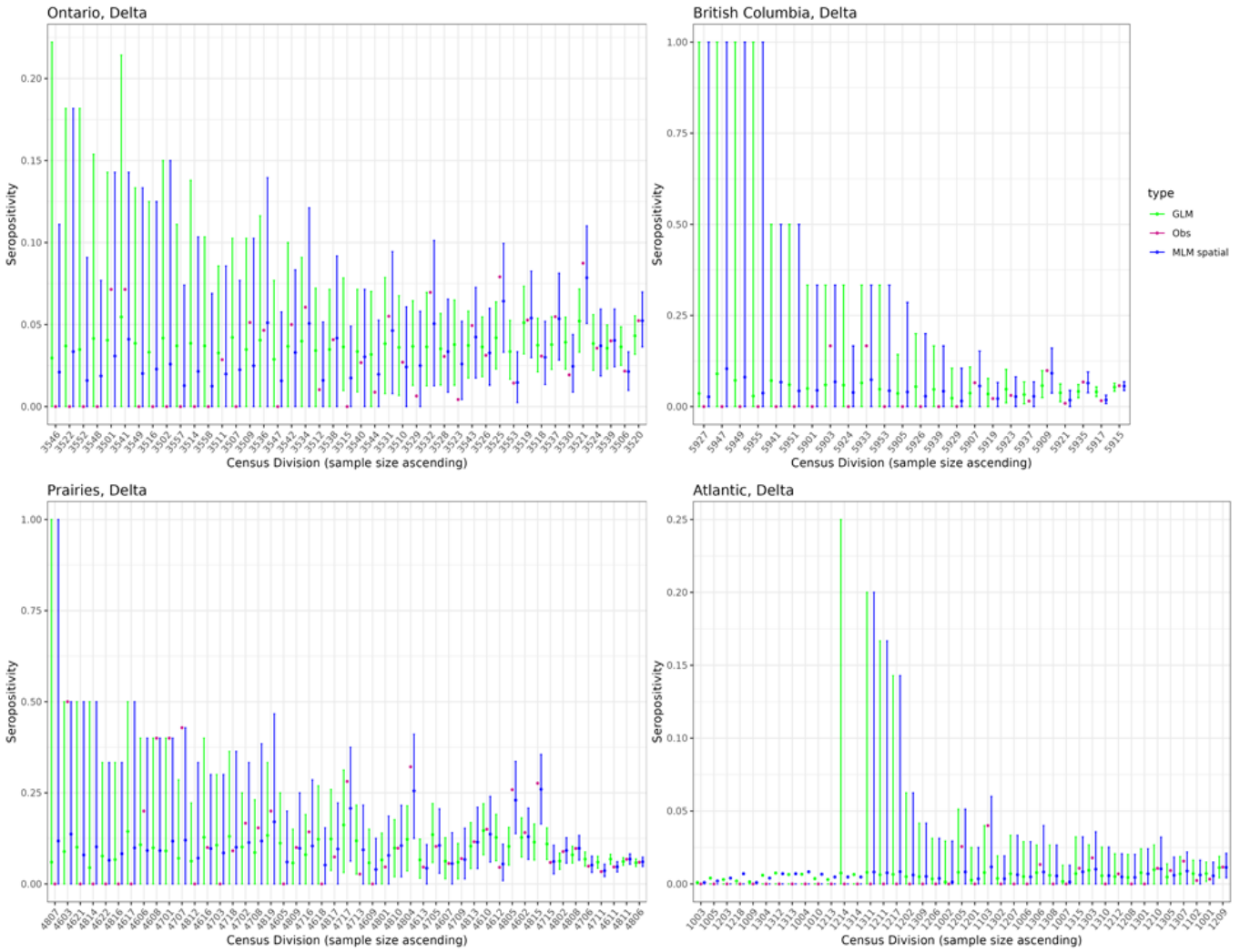

Figure S4: *Seropositivity estimation of Ontario and British Columbia (BC), Prairies and Atlantic during Delta period through multilevel model with/without spatial random effect. Specifically, 38 out of 43 census divisions for Ontario, 20 out of 24 for BC, 38 out of 47 for Prairies and 25 out of 41 for Atlantic obtain more accurate estimate from multi-level models with spatial effect (MLM spatial) compared to generalized linear models (GLM). Observed seropositivity (Obs) is also presented for a comparison.*

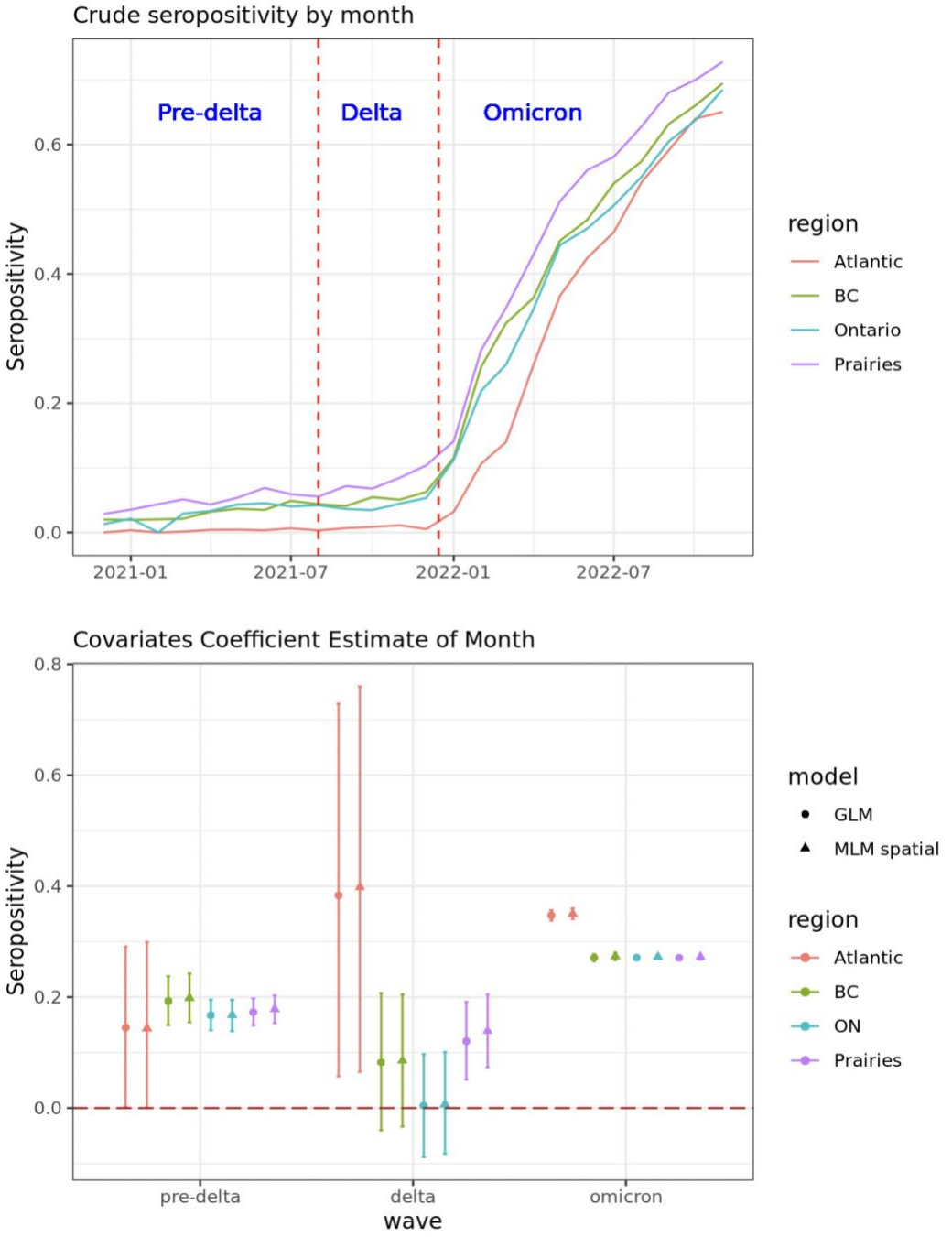

Figure S5: *Monthly seropositivity for each region which shows the trends through pandemic and corresponding coefficient estimates for month covariate.* [1]

[1] BC: British Columbia; ON: Ontario

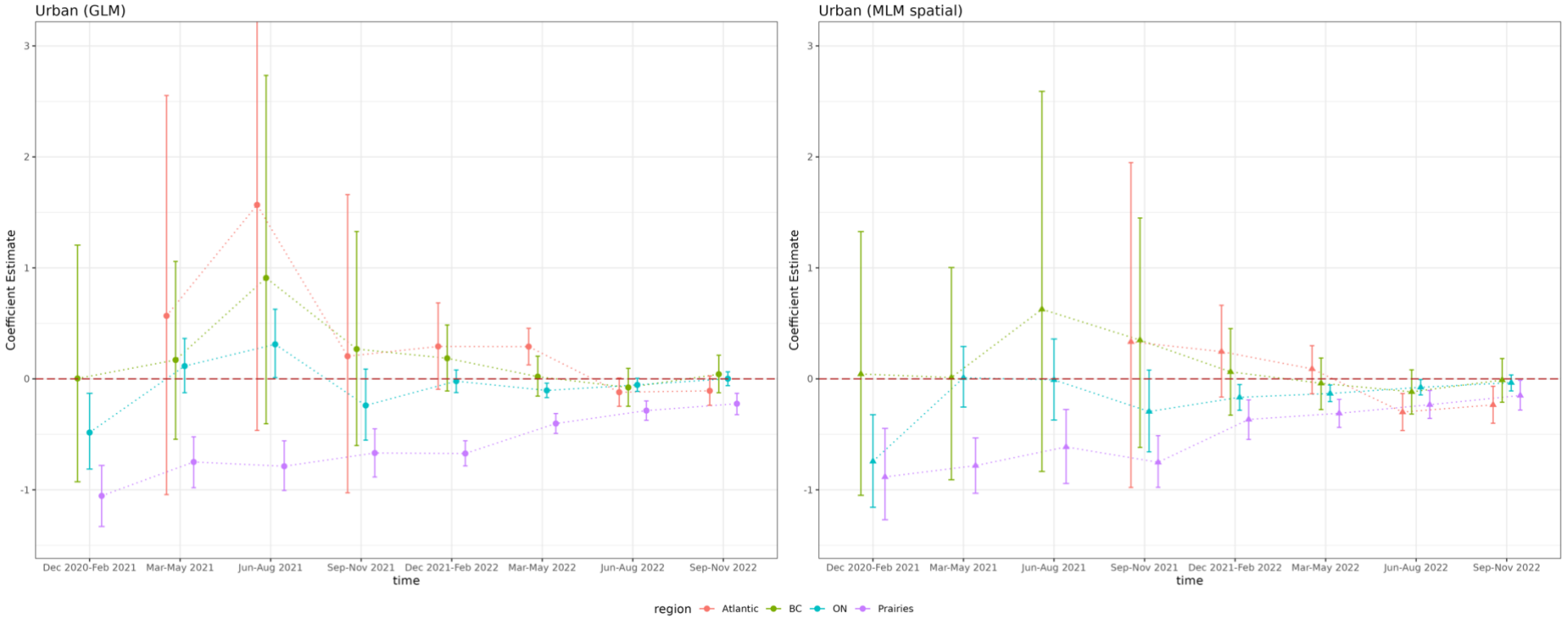

Figure S6: *Coefficient estimation trend of urbanicity: the urban effect tends to shrink to zero while from multi-level models with spatial effect (MLM spatial). Coefficient estimates from MLM spatial model of Ontario and the Prairies approaches from the negative side, and especially for Prairies the effect is continuously being significant. The MLM spatial model did not converge for the Atlantic region for earlier periods with few positive cases. R-hat was less than 1.1 for all models shown, indicating convergence.*[1]

[1] BC: British Columbia; ON: Ontario

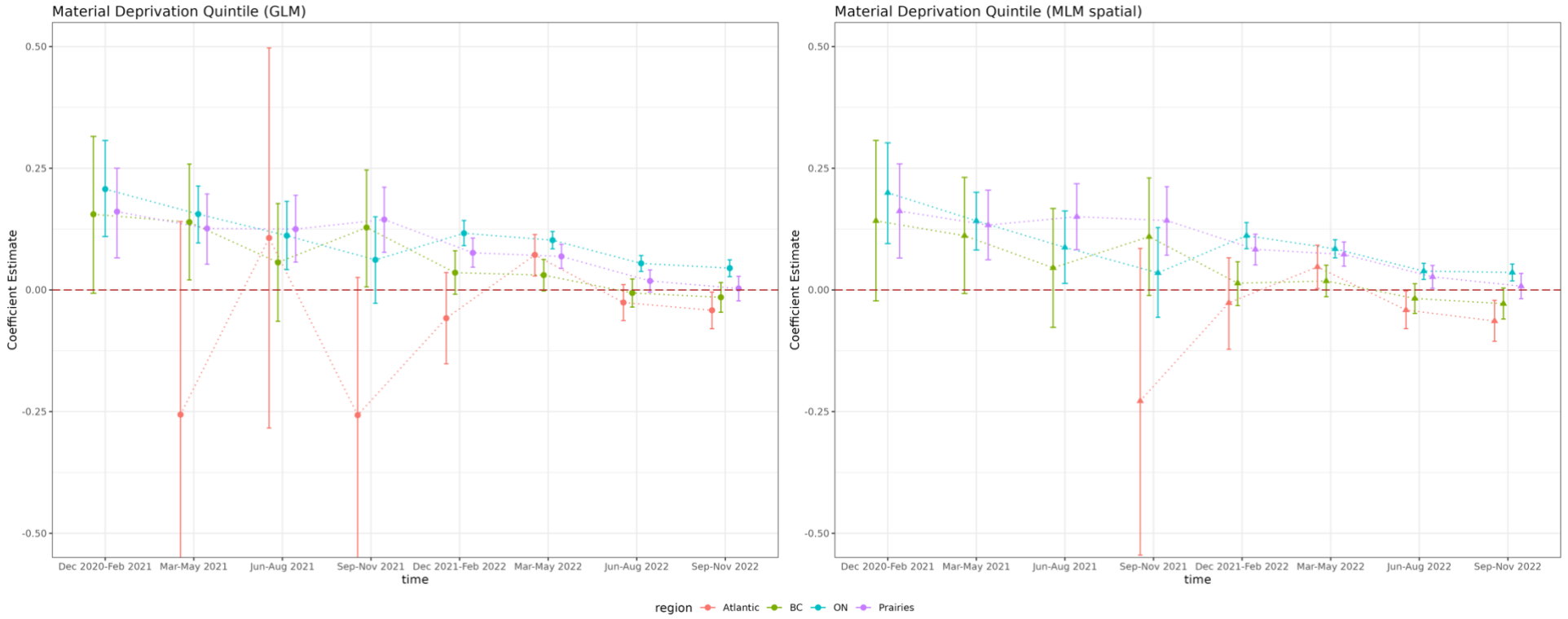

Figure S7: *Coefficient estimation trend of material deprivation quintile: it started from the positive side but has an obvious decreasing effect as the pandemic developed, especially compared to social deprivation index quintile. The multi-level models with spatial effect (MLM spatial) model did not converge for the Atlantic region for earlier periods with few positive cases. R-hat was less than 1.1 for all models shown, indicating convergence.* [1]

[1] BC: British Columbia; ON: Ontario

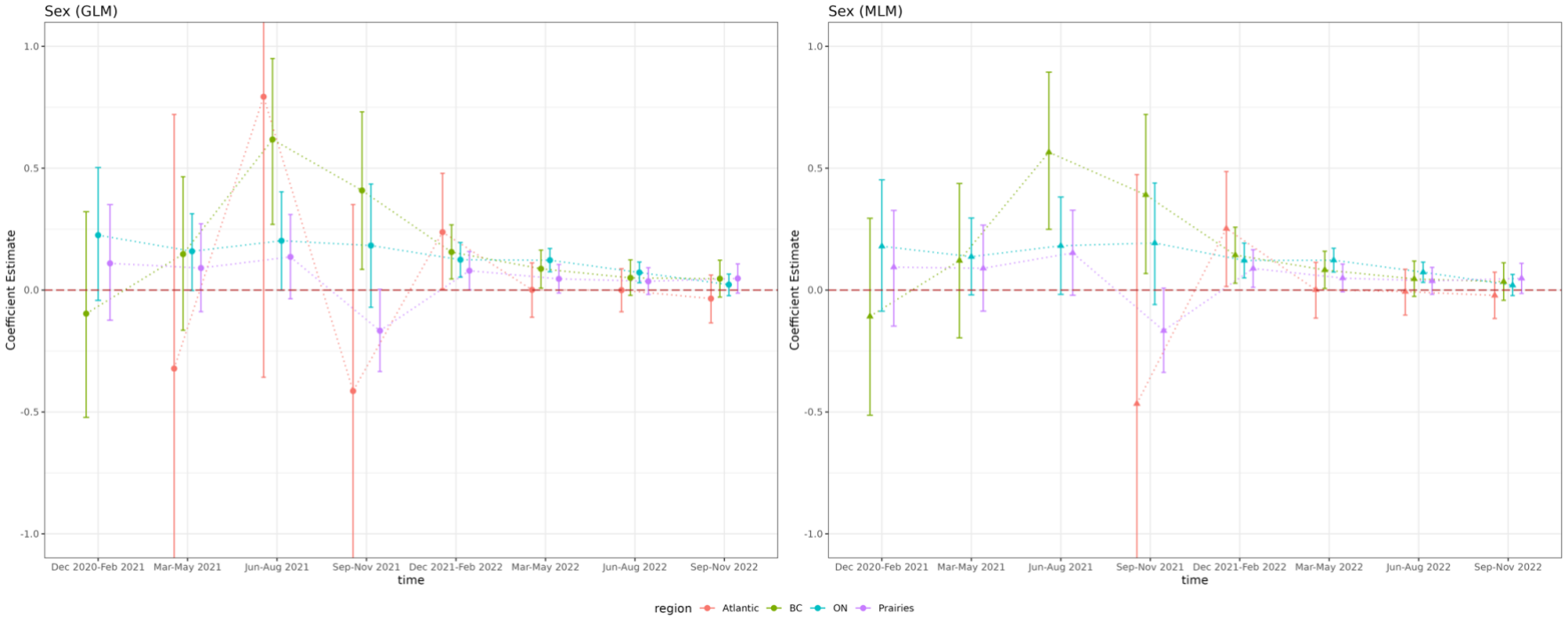

Figure S8: *Coefficient estimation trend of sex: sex effect stays at the positive side but seems to shrink proceeding to the Omicron wave. The multi-level models with spatial effect (MLM spatial) model did not converge for the Atlantic region for earlier periods with few positive cases. R-hat was less than 1.1 for all models shown, indicating convergence.* [1]

[1] BC: British Columbia; ON: Ontario

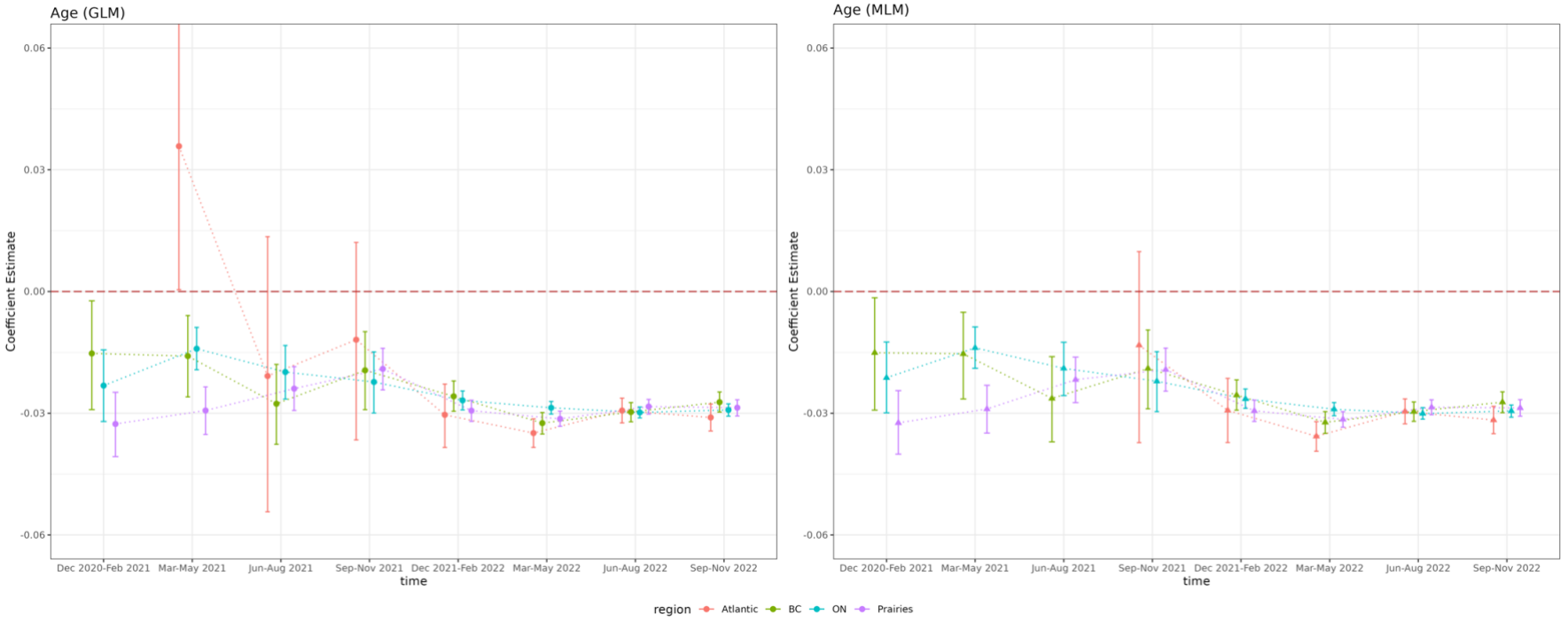

Figure S9: *Coefficient estimation trend of age: age continuously significantly affects the seropositivity rate negatively across pandemic period and reached about -0.03 from both models. The multi-level models with spatial effect (MLM spatial) model did not converge for the Atlantic region for earlier periods with few positive cases. R-hat was less than 1.1 for all models shown, indicating convergence.* [1]

[1] BC: British Columbia; ON: Ontario

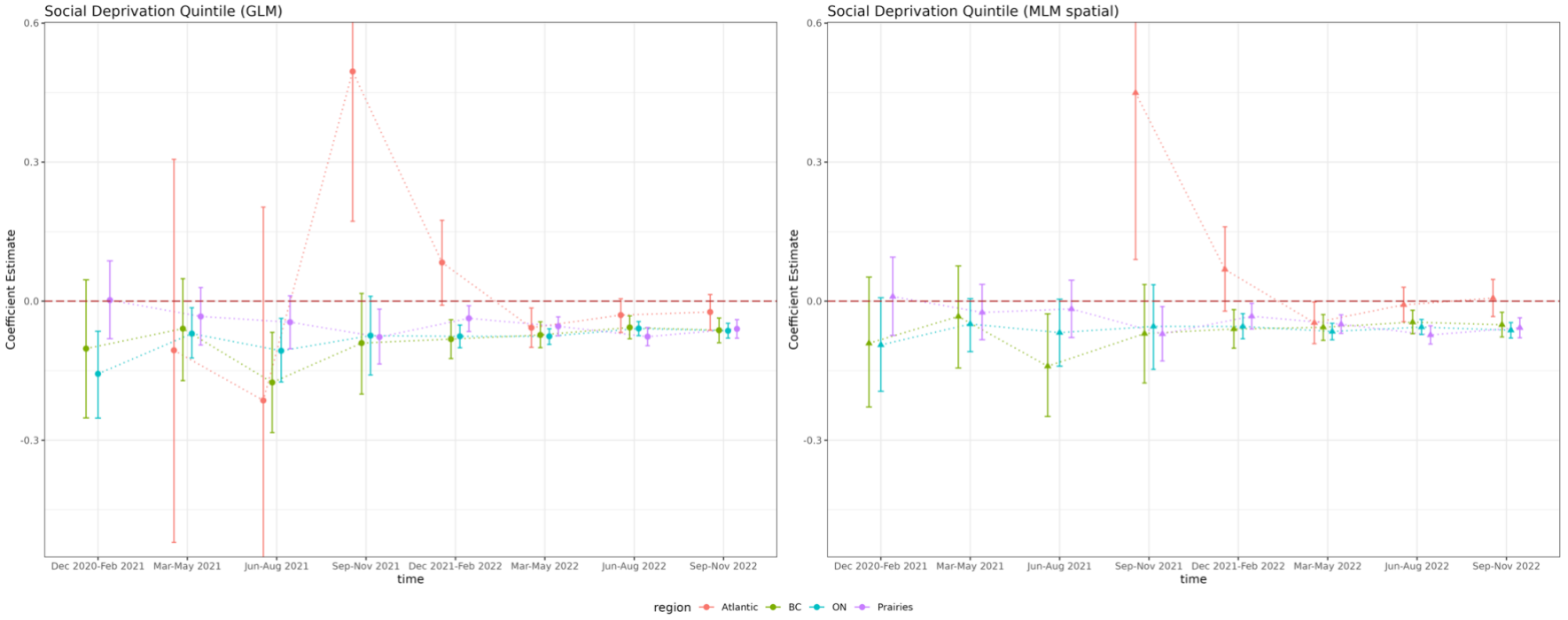

Figure S10: *Coefficient estimation trend of social deprivation quintile: opposite to the material deprivation, it affects the seropositivity negatively but the estimations are not gradually approaching zero-line as the material deprivation. The multi-level models with spatial effect (MLM spatial) model did not converge for the Atlantic region for earlier periods with few positive cases. R-hat was less than 1.1 for all models shown, indicating convergence.* [1]

[1] BC: British Columbia; ON: Ontario

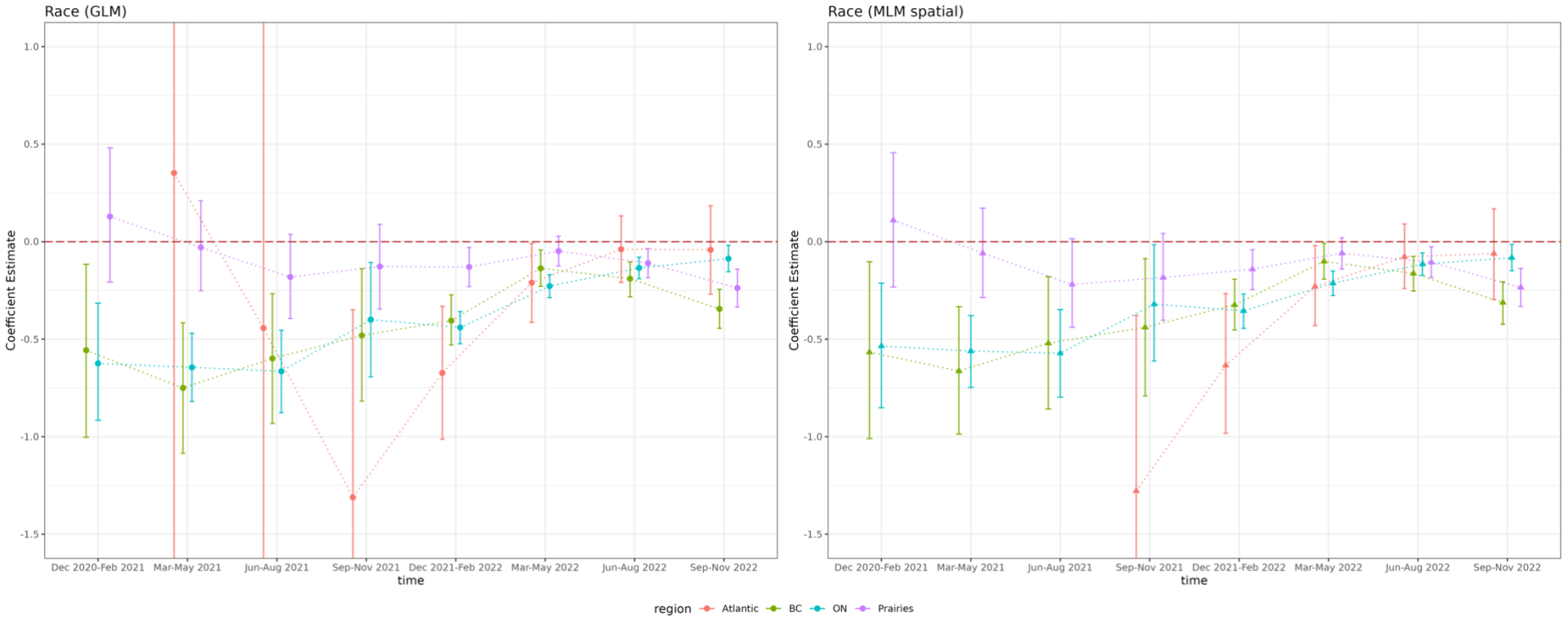

Figure S11: *Coefficient estimation trend of race: race effect remains on the negative side and being significant towards the end of Omicron but the estimation varies comparatively to the age effect from both models. The multi-level models with spatial effect (MLM spatial) model did not converge for the Atlantic region for earlier periods with few positive cases. R-hat was less than 1.1 for all models shown, indicating convergence.* [1]

[1] BC: British Columbia; ON: Ontario

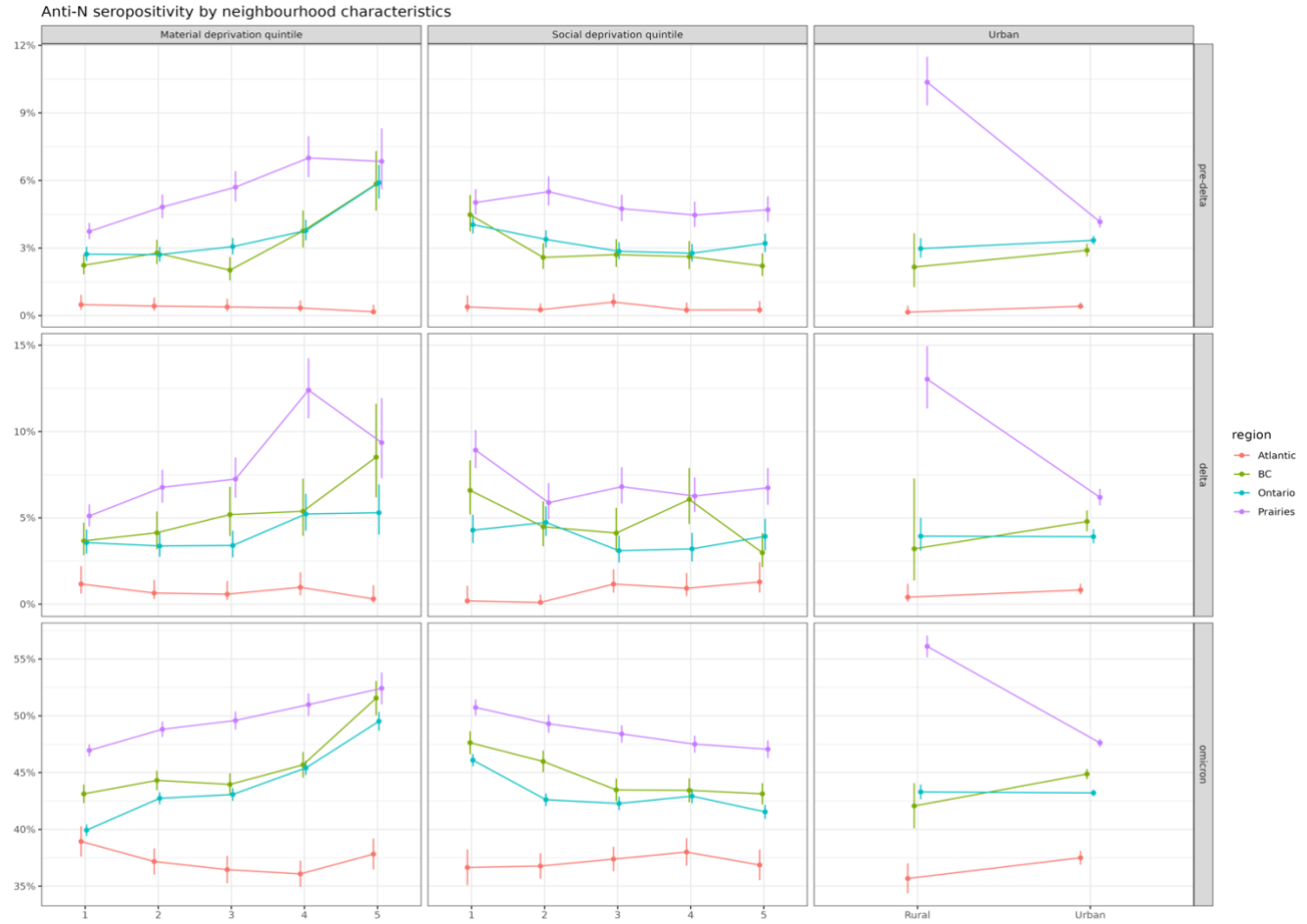

Figure S12: *Crude anti-N seropositivity stratified by neighborhood level characteristics in each region/wave* [1]

[1] BC: British Columbia

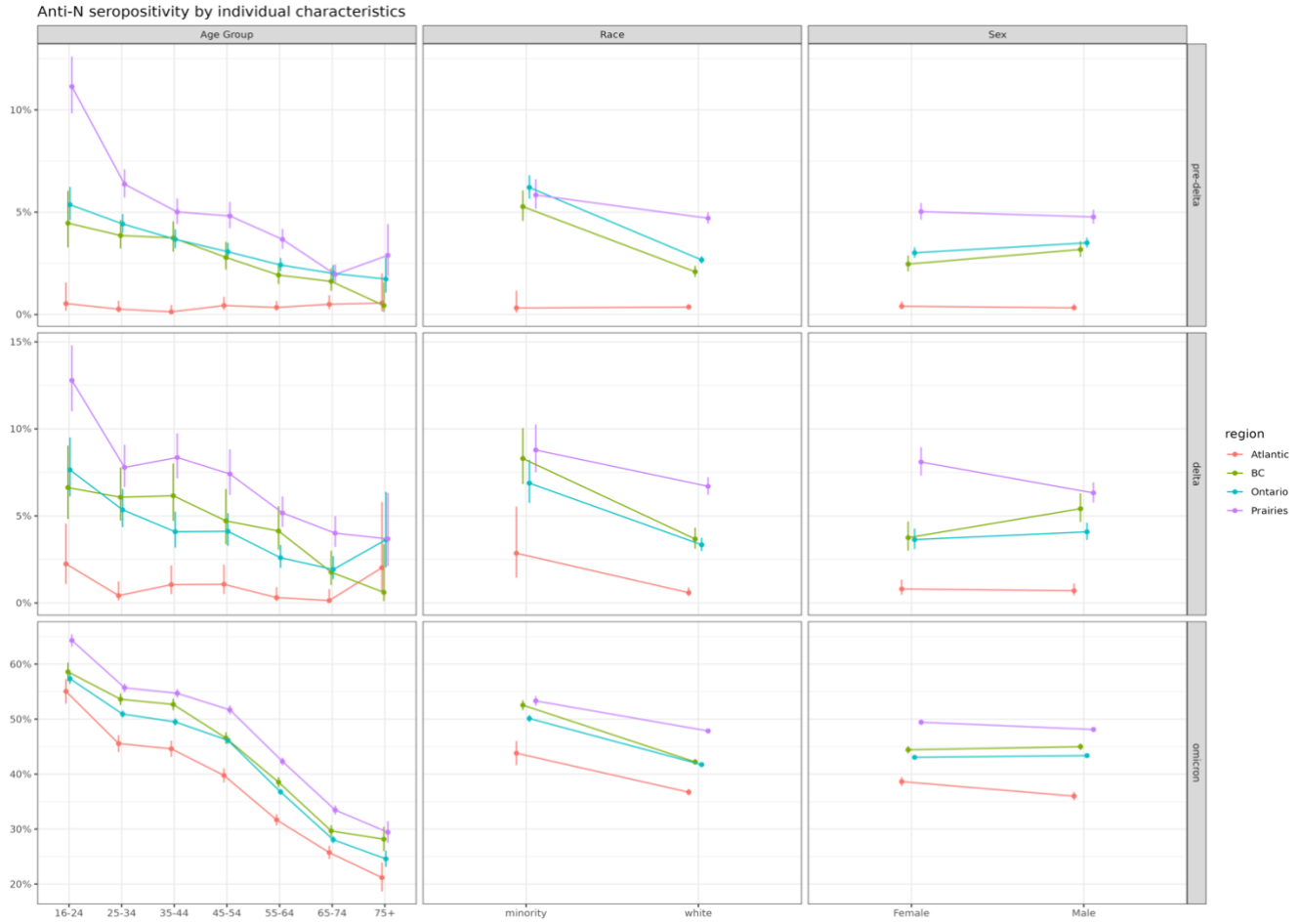

Figure S13: *Crude anti-N seropositivity stratified by individual level characteristics in each region/wave* [1]

[1] BC: British Columbia

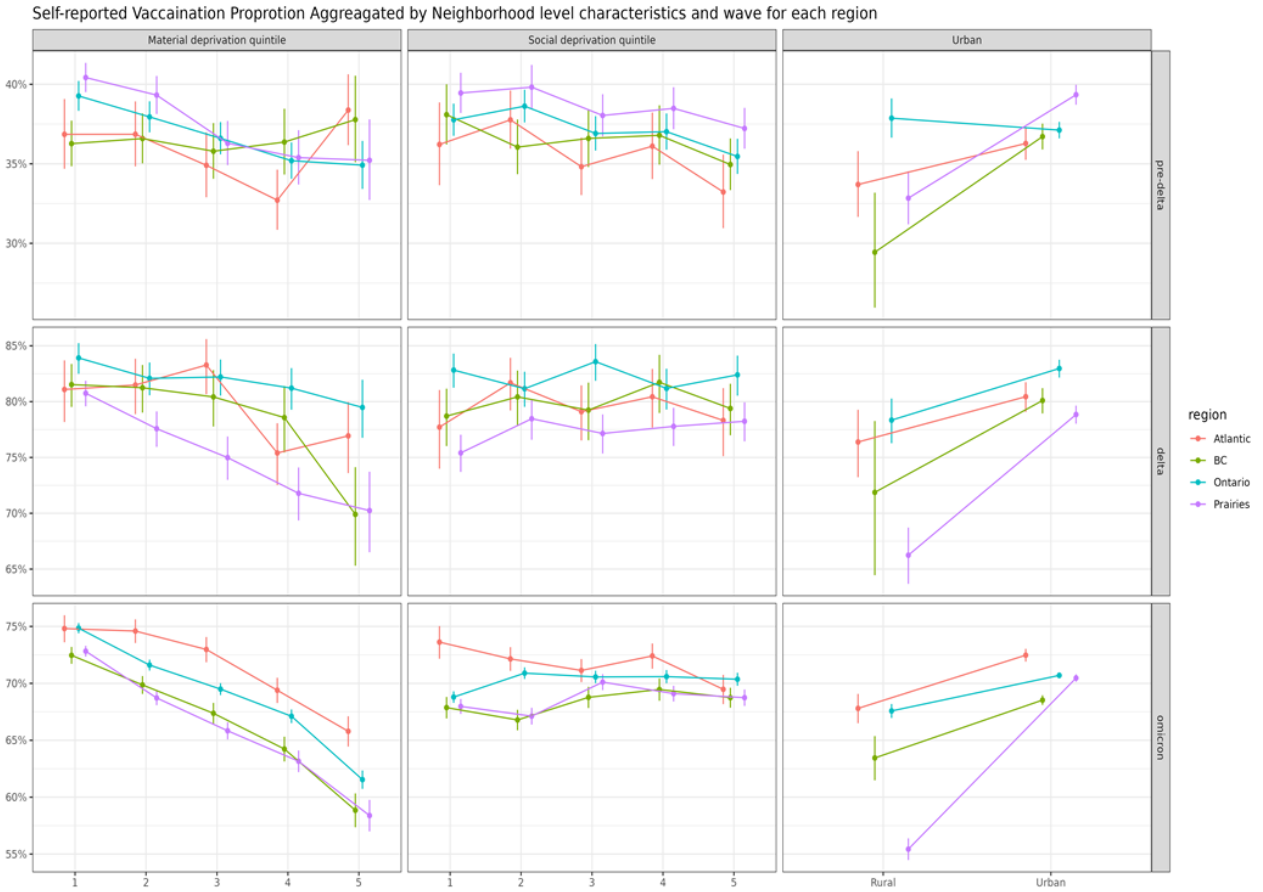

Figure S14: *Proportion of donors self-reporting a recent COVID-19 vaccination during their pre-donation questionnaire stratified by neighborhood level characteristics by region/wave (donors are asked to report any vaccinations they have received in the 3-month period before their blood donation)* [1]

[1] BC: British Columbia

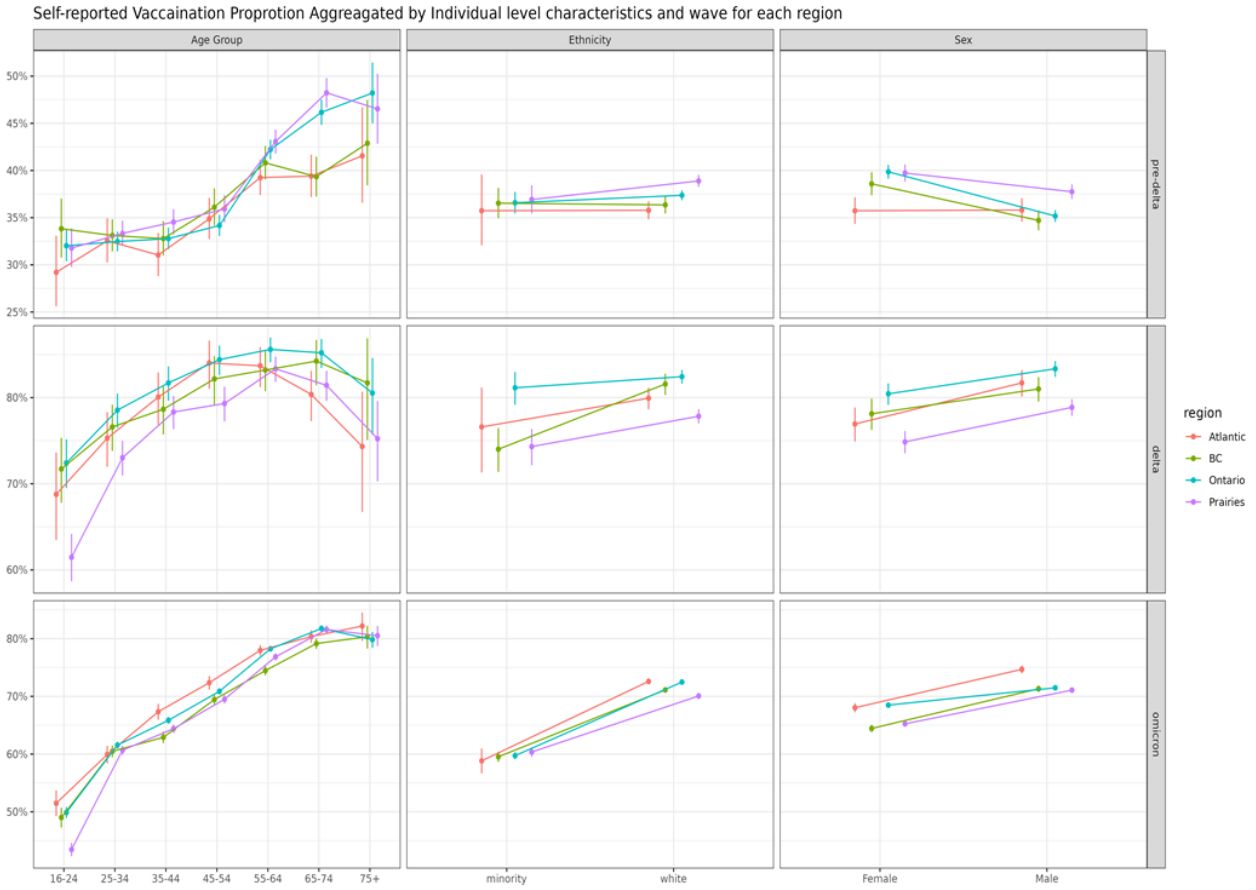

Figure S15: *Proportion of donors self-reporting a recent COVID-19 vaccination during their pre-donation questionnaire stratified by individual level characteristics by region/wave (donors are asked to report any vaccinations they have received in the 3-month period before their blood donation)* [1]

[1] BC: British Columbia

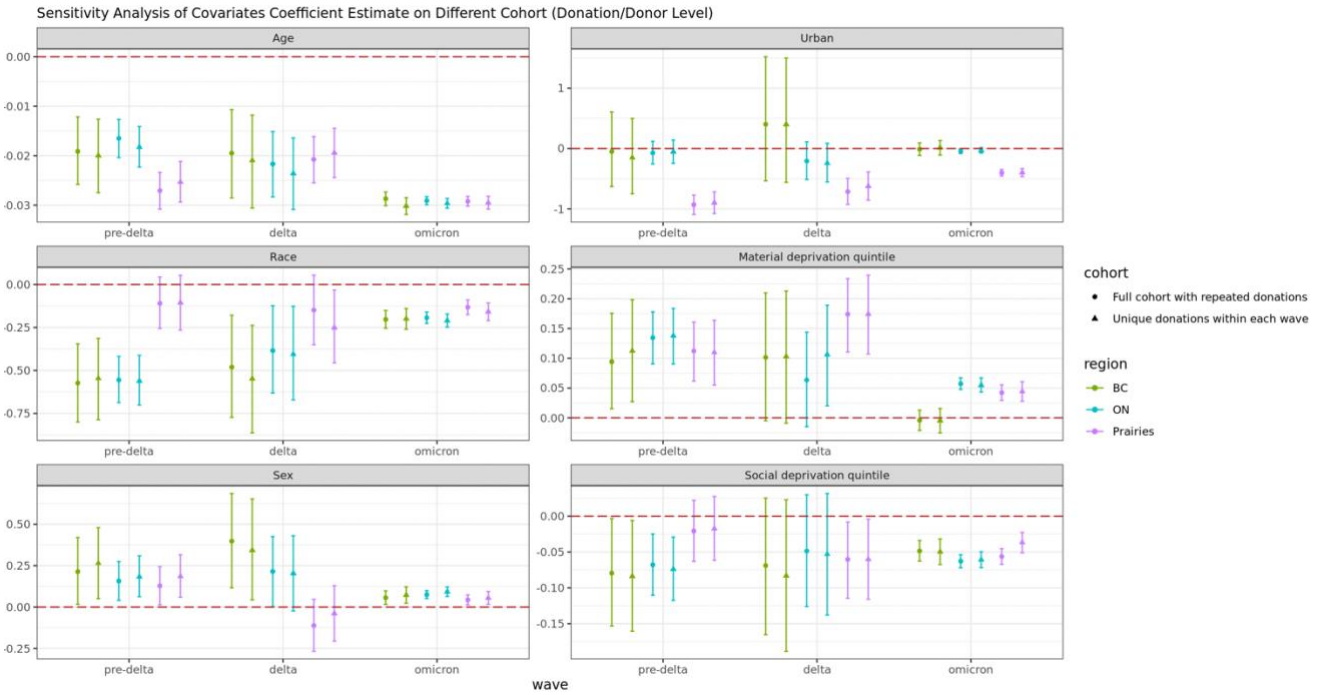

Figure S16: *Comparison of the coefficients estimation from multi-level models with spatial effect (MLM spatial) model from different cohort a) Full cohort with repeated donations b) Unique donation within each wave where one sample per donor was randomly selected.* [1]

[1] BC: British Columbia; ON: Ontario