

Supplementary information for:

Cross-sectional study for COVID-19-related mortality predictors in a Brazilian state-wide landscape: The role of demographic factors, symptoms, and comorbidities

RUNNING TITLE

COVID-19 mortality predictors in South Brazil

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Additional Methods

The geographical distribution plots of all records of positive cases and deaths were generated using the latitudes and longitudes of the municipalities, provided by the Brazilian Institute of Geography and Statistics (1), which were transformed into geometric coordinates using the Leaflet package in the R environment (2).

To compare Paraná with São Paulo State (in the Southeast region, located immediately above Paraná) regarding COVID-19 cases and deaths, data were obtained from the Regional Health Department web repository <https://github.com/seade-R/dados-covid-sp>, which aggregates daily updates from São Paulo State health authorities.

Histograms for each dataset were built for exploratory analysis and to evaluate the COVID-19 symptoms and comorbidity prevalence. This analysis considered the number of recoveries and deaths for each of the three sub-groups and was performed using ggplot2 in the R environment (3).

References

1. IBGE. Projeções da População. Censo Brasileiro de 2010. 2019.
2. Graul C. leafletR: Interactive Web-Maps Based on the Leaflet JavaScript Library . 2016.
Available from: <http://cran.r-project.org/package=leafletR>
3. Wickham H. ggplot2: Elegant Graphics for Data Analysis . Springer-Verlag New York; 2016.
Available from: <https://ggplot2.tidyverse.org>

Table S1. Descriptive demographic data and clinical for COVID-19 patients for total Symptoms group and in three levels of severity/medical interventions.

Aspects	All (n=101280)		NH(n=93,942)		Non-ICU (n=5252)		ICU (n=2,086)	
Demographics								
Sex	n	%	n	%	n	%	n	%
Female	54,798	54.11	51,609	54.94	2,384	45.39	805	38.59
Male	46,482	45.89	42,333	45.06	2,868	54.61	1,281	61.41
Age-Group								
25-30	25,725	25.40	25,429	27.07	249	4.74	47	2.25
30-35	13,062	12.90	12,758	13.58	249	4.74	55	2.64
35-40	12,349	12.19	11,960	12.73	312	5.94	77	3.69
40-45	10,716	10.58	10,241	10.90	389	7.41	86	4.12
45-50	9,698	9.58	9,116	9.70	456	8.68	126	6.04
50-55	8,521	8.41	7,813	8.32	555	10.57	153	7.33
>55	21,209	20.94	16,625	17.70	3,042	57.92	1,542	73.92
Symptoms								
Fever	41,445	40.92	37,337	39.74	2,897	55.16	1211	58.05
Cough	66,066	65.23	60,600	64.51	3,928	74.79	1,538	73.73
SoreThroat	46,733	46.14	44,643	47.52	1,557	29.65	1,538	73.73
Myalgia	55,140	54.44	51,807	55.15	2,470	47.03	863	41.37
Diarrhea	17,696	17.47	16,390	17.45	948	18.05	358	17.16
Headache	61,948	61.17	59,037	62.84	2,218	42.23	693	33.22
Anosmia	25,058	24.74	23,877	25.42	867	16.51	314	15.05
Dyspnoea	21,023	20.76	16,783	17.87	2,747	52.30	1,493	71.57
Fatigue	27,310	26.96	24,758	26.35	1,785	33.99	767	36.77
Chill	21,142	20.87	19,788	21.06	1,010	19.23	344	16.49
Nasalcong	21,179	20.91	20,331	21.64	642	12.22	206	9.88
Nausea_vomit	14,126	13.95	12,823	13.65	943	17.96	306	14.67
Sputum	6,899	6.81	6,388	6.80	364	6.93	147	7.05
Dizziness	2,508	2.48	2154	2.29	232	4.42	122	5.85

Table S2. Descriptive demographic data and clinical for COVID-19 patients for total Comorbidities group and in three levels of severity/medical interventions.

Aspects	All (n=102,962)		NH(n=95,352)		Non-ICU (n=5,484)		ICU(n=2,126)	
Demographics								
Sex	n	%	n	%	n	%	n	%
Female	55,595	54.00	52,218	54.76	2,541	46.33	1,290	60.68
Male	47,367	46.00	43,134	45.24	2,943	53.67	836	39.32
Age-Group								
25-30	26,129	25.38	25,696	26.95	387	7.06	46	2.16
30-35	13,307	12.92	12,954	13.59	294	5.36	59	2.78
35-40	12,522	12.16	12,100	12.69	344	6.27	78	3.67
40-45	10,970	10.65	10,474	10.98	417	7.60	79	3.72
45-50	9,902	9.62	9,279	9.73	490	8.94	133	6.26
50-55	8,638	8.39	7,932	8.32	544	9.92	162	7.62
>55	21,494	20.88	16,917	17.74	3,008	54.85	1,569	73.80
Comorbidities								
Heart_Disease	4,369	4.24	2,822	2.96	893	16.28	654	30.76
Hypertension	16,083	15.62	13,119	13.76	1,906	34.76	1,058	49.76
Diabetes	6,648	6.46	4,808	5.04	1,116	20.35	724	34.05
Hepatic_Disease	423	0.41	321	0.34	65	1.19	37	1.74
Neuro_Disease	1,007	0.98	632	0.66	214	3.90	161	7.57
Down	39	0.04	29	0.03	5	0.09	5	0.24
Imunod	488	0.47	345	0.36	88	1.60	55	2.59
ImunoD_Hiv	162	0.16	145	0.15	12	0.22	5	0.24
Kidney_Disease	863	0.84	533	0.56	147	2.68	183	8.61
C_PulD	2,884	2.80	2,244	2.35	392	7.15	248	11.67
Neopl_D	609	0.59	345	0.36	158	2.88	106	4.99
Puerperium	100	0.10	87	0.09	8	0.15	5	0.24
Obesity	4,939	4.80	4,087	4.29	510	9.30	342	16.09
Tabagism	3,909	3.80	3,523	3.69	268	4.89	118	5.55

Table S3. Stepwise analysis to fit the best model to predict mortality in Non-Hospitalized-Symptoms-data. Univariate analysis with Wald-test results showing the association with mortality. Multivariate analysis of fixed and random effects using the lower AIC criteria.

NH	Unadjusted Univariate			Multivariate adjusted fixed effects			Multivariate adjusted for the best fit with random effects		
	Estimate	Wald-test	p-value	Estimate	AIC	p-value	Estimate*	AIC	p-value
Sex	1.97	61.57	4.31E-15	1.03	-218626	1.12E-10	1.76	4993.9	
Age		100.91	2.22E-16	1.00	-217358	2.20E-16		5859.9	
30-35	1.66						1.62		
35-40	4.25						4.05		
40-45	6.21						5.76		
45-50	14.45						13.09		
50-55	20.7						18.07		
>55	116						88.12		
HDI	8E-04	58.27	2.31E-14	1.00	-218633	3.16E-09	0.03		
Cough	1.65	26.14	3.17E-07	1.01	-218665	0.075596			
SoreThroat	0.38	98.04	2.22E-16	1.01	-218631	1.49E-09	0.57	4987	1.64E-08
Headache	0.33	154.62	2.22E-16	1.00	-218593	2.20E-16	0.48	5012.2	4.32E-14
Myalgia	0.69	18.51	1.68E-05	1.00	-218651	5.42E-05	0.71	4967.5	0.000441
Fever	1.58	29.31	6.18E-08	1.02	-218646	3.17E-06	1.57	4979.6	7.54E-07
Dyspnoea	4.13	277.99	2.22E-16	0.96	-218359	2.20E-16	4.14	5175.8	2.20E-16
Fatigue	1.76	42.91	5.75E-11	1.01	-218654	0.000158	1.24	4960	0.027127
Diarrhea	1.04	0.17	0.67	1.00					
Nasalcong	0.41	39.35	3.55E-10	0.99	-218652	5.93E-05	0.64	4965.3	0.001493
Chill	0.93	0.43	0.51	1.01					
Nausea_vomit	1.2	2.87	0.09	0.99					
Sputum	1.12	0.57	0.45	0.99					
Dizziness	1.68	5.53	0.01	0.99	-218666	0.244636			

Table S4. . Stepwise analysis to fit the best model to predict mortality in Non-ICU-Symptoms-data. Univariate analysis with Wald-test results showing the association with mortality. Multivariate analysis of fixed and random effects using the lower AIC criteria.

No-ICU	Unadjusted Univariate			Multivariate adjusted fixed effects			Multivariate adjusted for the best fit with random effects		
	Estimate	Wald-test	p-value	Estimate	AIC	p-value	Estimate*	AIC	p-value
Sex	1.03	7.31	0.007	1.02	4547.8	0.010868	1.22	4349	0.011849
Age	1.08	80.35	2.22E-16	1.03	4869.2	2.20E-16		4700.9	2.20E-16
30-35	1.02			1.02			2.28		
35-40	1.01			1.02			2.09		
40-45	1.04			1.03			2.72		
45-50	1.04			1.03			2.88		
50-55	1.06			1.05			3.68		
>55	1.30			1.26			14.96		
HDI	0.74	2.22E-16	0.015	0.80	4544.6	0.072725			
Cough	0.98	5.31	0.02	0.97	4544.2	0.090761			
SoreThroat	0.00045	73.89	2.22E-16	0.97	4552.9	0.00067	0.71	4355.1	0.000409
Headache	0.87	135.3	2.22E-16	0.94	4564.1	1.86E-06	0.59	4376.6	5.63E-09
Myalgia	0.90	83.18	2.22E-16	0.95	4557.7	5.19E-05	0.69	4361.3	1.60E-05
Fever	0.99	0.002	9.50E-01	0.95					
Dyspnoea	1.15	170.52	2.22E-16	1.13	4687.1	2.20E-16	2.41	4457.1	2.20E-16
Fatigue	1.01	1	3.10E-01						
Diarrhea	0.96	9.63	1.00E-03	0.98	4542.7	0.234051			
Nasalcong	0.91	29.5	5.82E-08	0.97	4543.9	0.106003			
Chill	0.93	24.62	5.82E-08	0.96	4545.9	0.031729			
Nausea_vomit	0.97	4.52	3.00E-02	1.01	4542	0.406202			
Sputum	1.02	1.22	2.60E-01				0.76		0.02
Dizziness	1.17	33.91	6.08E-09	1.12	4565	1.15E-06	1.91	4357.5	0.000118

Table S5. Stepwise analysis to fit the best model to predict mortality in ICU-Symptoms-data. Univariate analysis with Wald-test results showing the association with mortality. Multivariate analysis of fixed and random effects using the lower AIC criteria.

ICU	Unadjusted Univariate			Multivariate adjusted fixed effects			Multivariate adjusted for the best fit with random effects		
	Estimate	Wald-test	p-value	Estimate	AIC	p-value	Estimate*	AIC	p-value
Sex	1.01	0.537493	0.46356	1.02	2546.6	0.244	1.14	2377.1	0.231856
Age	1.00	20.55353	2.22E-16		2640.7	2.00E-16		2471.5	2.20E-16
30-35	0.01		0.96	1.01		0.93	0.99		
35-40	0.03		0.73	1.04		0.65	1.21		
40-45	0.06		0.5	1.07		0.39	1.38		
45-50	0.18		0.02	1.20		0.02	2.23		
50-55	0.26		0.001	1.29		0.001	3.11		
>55	0.36		0.001	1.40		0.001	5.11		
HDI	1.47	2.619312	0.10572						
Cough	0.97	2.100707	0.14738						
SoreThroat	0.88	28.09258	1.28E-07	0.96	2548.6	0.06602			
Headache	0.87	40.01115	3.08E-10	0.95	2550.9	0.01705	0.72	2383.4	0.005375
Myalgia	0.89	31.29248	2.51E-08	0.95	2549.7	0.0342	0.73	2383.2	0.006073
Fever	0.97	2.725144	0.09893						
Dyspnoea	1.09	17.04389	3.80E-05	1.07	2555.5	0.00132	1.38	2383.3	0.00584
Fatigue	0.98	1.034153	0.3093						
Diarrhea	0.99	0.496442	0.48115						
Nasalcong	0.89	11.86688	0.000583	0.97	2546	0.37302			
Chill	0.88	20.70085	5.68E-06	0.95	2547.6	0.11936			
Nausea_vomit	0.97	1.563275	0.21133						
Sputum	0.94	2.913005	0.088017						
Dizziness	1.07	3.22246	0.072779						

Table S6. Stepwise analysis to fit the best model to predict mortality in Non-Hospitalized-Comorbidities-data. Univariate analysis with Wald-test results showing the association with mortality. Multivariate analysis of fixed and random effects using the lower AIC criteria.

NH	Unadjusted Univariate			Multivariate adjusted fixed effects			Multivariate adjusted for the best fit with random effects		
	Estimate	Wald-test	p-value	Estimate	AIC	p-value	Estimate*	AIC	p-value
Sex	1.03	47.95161	4.40E-12	1.00	-217702	9.36E-14	1.89	5406.7	0.001
Age	1.00	108.1738	2.22E-16		-217000	2.20E-16			
30-35	1.00			1.00			1.66		0.32
35-40	1.00			1.00			3		0.017
40-45	1.00			1.00			5.82		0.001
45-50	1.00			1.00			10.81		0.001
50-55	1.00			1.00			15.48		0.001
>55	1.02			1.02			65.92		0.001
HDI	0.96	48.36719	3.56E-12	0.97	-217738	1.18E-05	0.03	5306	0.001
Heart_Disease	1.04	276.9764	2.22E-16	1.03	-217464	2.20E-16	2.33	5288	0.001
Hypertension	1.01	497.9996	2.22E-16	1.00	-217749	0.005042	1.18	5293	0.97
Diabetes	1.03	531.2355	2.22E-16	1.02	-217576	2.20E-16	1.84	5297	0.001
Hepatic_Disease	1.01	15.61419	7.77E-05	1.00	-217756	0.390623			
Neuro_Disease	1.04	164.8617	2.22E-16	1.04	-217629	2.20E-16	2.59	5346	0.001
Down	1.03	2.951742	0.085788						
Imunod	1.01	14.05571	0.000178	1.01	-217755	0.188243			
ImunoD_Hiv	0.99	0.003323	0.95403						
Kidney_Disease	1.03	93.67754	2.22E-16	1.03	-217704	3.42E-13	2.22	5421	0.001
C_PulD	1.01	79.24823	2.22E-16	1.01	-217727	3.54E-08	1.65	5418	0.003
Neopl_D	1.03	49.30058	2.21E-12	1.01	-217735	2.94E-06	2.12	5415	0.013
Puerperium	1.00	0.002674	0.99733						
Obesity	1.01	124.5676	2.22E-16	1.01	-217705	5.45E-13	2.18	5414	0.001
Tabagism	1.00	4.050578	0.044159	1.00	-217757	0.638568			

Table S7. Stepwise analysis to fit the best model to predict mortality in Non-ICU-Comorbidities-data. Univariate analysis with Wald-test results showing the association with mortality. Multivariate analysis of fixed and random effects using the lower AIC criteria.

NO-ICU	Unadjusted Univariate			Multivariate adjusted fixed effects			Multivariate adjusted for the best fit with random effects		
	Estimate	Wald-test	p-value	Estimate	AIC	p-value	Estimate*	AIC	p-value
Sex	1.03	8.90963	0.002849		4281.6	0.001597	1.3	4226	0.001544
Age	1.00	65.69981	2.22E-16		4540.6	2.20E-16		4538.6	2.20E-16
30-35	1.00		0.86				1.4		
35-40	1.01		0.66				1.65		
40-45	1.03		0.31				1.83		
45-50	1.05		0.07				2.66		
50-55	1.06		0.02				2.85		
>55	1.31		0.001				11.65		
HDI	0.73	6.979079	0.00827		4271.8	0.668197			
Heart_Disease	1.25	128.9468	2.22E-16		4341.3	2.79E-16	1.87	4256.4	6.29E-10
Hypertension	1.13	138.4301	2.22E-16		4272.2	0.46941			
Diabetes	1.14	110.2959	2.22E-16		4281.9	0.001389	1.42	4230.9	0.000112
Hepatic_Disease	1.15	7.960462	0.004798		4272.6	0.320312			
Neuro_Disease	1.45	152.106	2.22E-16		4369.5	2.20E-16	3.39	4268.6	4.16E-13
Down	1.01	0.007564	0.9307						
Imunod	1.29	34.82335	3.83E-09		4281	0.002219	1.97	4221.6	0.018043
ImunoD_Hiv	0.99	0.026498	0.8707						
Kidney_Disease	1.24	45.1812	1.98E-11		4292.4	5.13E-06	2.39	4233.4	3.08E-05
C_PulD	1.23	100.9801	2.22E-16		4313.5	9.93E-11	2.2	4251.6	2.48E-09
Neopl_D	1.28	57.86036	3.29E-14		4311.6	2.53E-10	3.19	4247.9	1.60E-08
Puerperium	0.71	0.209422	0.81106						
Obesity	1.02	1.960083	0.16156		4272.7	0.299411			
Tabagism	1.08	10.70516	0.001075		4271.7	0.747745			

Table S8. Stepwise analysis to fit the best model to predict mortality ICU-Comorbidities-data. Univariate analysis with Wald-test results showing the association with mortality. Multivariate analysis of fixed and random effects using the lower AIC criteria.

ICU	Unadjusted Univariate			Multivariate adjusted fixed effects			Multivariate adjusted for the best fit with random effects		
	Estimate	Wald-test	p-value	Estimate	AIC	p-value	Estimate*	AIC	p-value
Sex	1.00	0.145429	0.70298						
Age		21.0627	2.22E-16		2580.4	1.08E-14		2371.1	2.84E-12
30-35	1.03						1.13		
35-40	1.10						1.71		
40-45	1.11						1.74		
45-50	1.20						1.93		
50-55	1.32						2.81		
>55	1.49						4.42		
HDI	1.20	0.658873	0.41705						
Heart_Disease	1.19	69.48638	2.22E-16		2535.9	1.44E-06	2.11	2348.8	6.53E-09
Hypertension	1.12	36.20695	2.08E-09		2513.4	0.386335			
Diabetes	1.13	42.83768	7.43E-11		2530.1	3.08E-05	1.66	2333.6	1.78E-05
Hepatic_Disease	0.91	0.003166	0.95514						
Neuro_Disease	1.16	16.65267	4.65E-05		2521.5	0.002953	2.16	2326.5	0.000772
Down	0.91	0.227272	0.6336						
Imunod	1.15	4.838677	0.027936		2514	0.249154			
ImunoD_Hiv	0.91	0.227272	0.6336						
Kidney_Disease	1.17	21.03486	4.77E-06		2523	0.001317	2.13	2327	0.000576
C_PulD	1.09	9.208434	0.002438		2515.7	0.085486	1.48	2320.1	0.026935
Neopl_D	1.18	13.89966	0.000198		2524.2	0.000689	3.22	2332.2	3.63E-05
Puerperium	0.44	1.988647	0.13714						
Obesity	0.99	0.249702	0.61734						
Tabagism	1.08	3.851086	0.049844		2513	0.558612			

* The interactions tested between the categorical variables, including demographics and clinical aspects, were not significant, and the evaluated model did not show superior support to the best model described in the tables.