A Comprehensive County Level Model to Identify Factors Affecting Hospital Capacity and Predict Future Hospital Demand

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Supplemental Material

A1. Non-COVID Hospitalization Model

COVID-19 Related Factors: As hypothesized, we find that an increase in weekly COVID transmission rate in the county results in a decrease in the non-COVID hospitalization rate. The result highlights how COVID-19 cases are affecting the general population's perception of hospital safety. It is also possible that hospitals are delaying hospitalization of other non-emergency patients to allow for requisite beds for COVID patients.

Demographics: As expected, counties with higher percentage of young individuals are less likely to experience higher non-COVID hospitalization rate. Similar to the COVID hospitalization trend, we find increased presence of minority population including Hispanic and African-American people in a county significantly increases hospitalization risk. Finally, our results show that women usually have a high hospitalization rate compared to men.

Health Indicators: Consistent with previous research, we also find that people suffering from pre-existing chronic diseases including cancer and HIV significantly increase the risk of being hospitalized.

Spatial Factors: With respect to spatial factors, we observe that mid-west region is more likely to have higher number of non-COVID hospitalization rates relative to other regions.

Temporal Factors: Similar to the COVID hospitalization model, we tested for the influence of temporal variables on the non-COVID hospitalization rate. We did not find any influence of the indicator variable from October 30th in the model. However, we did find the indicator variable from December 25th providing a mirror image of the results from COVID hospitalization rates. To elaborate, the variable reveals a negative coefficient indicating a reduced likelihood of the number of non-COVID patients across the country since 25th December. This variable directly reflects the influx of COVID patients reducing hospital capacity for non-COVID patients.

Correlation Factors: Similar to the COVID hospitalization rate, we also find the presence of common unobserved factors influencing county non-COVID hospitalization rate.

A2. ICU Usage Model (COVID and Non-COVID)

Discussion about the ICU usage model will be provided upon request from the authors.

Table A.1: ICU Model Results

	COVID		**Non COVID**	
Parameter	Estimate	t-statistics	Estimate	t-statistics
Intercept	-11·038	-8·612	-20·854	-10·978
Covid-19 Related Factors				
COVID case per 100 people, with 1 week lag	--**	--	-0·056	-3·044
COVID case per 100 people, with 2 weeks lag	0·659	13·045	-0·054	-2·859
x Effect in Mid-West Region	-0·260	-4·440	--	--
x Effect in South Region	-0·324	-5·762	--	--
x Effect in North-east Region			-0·169	-2·018
% difference from 3 week moving average	0·037	3·347	--	--
x Effect in Mid-West Region	0·022	1·732	--	--
Weekly Covid-19 cases higher than the moving average (base is covid-19 cases same or lower)	0·017	2·346	--	--
Mobility Trends				
Ln (Daily Average Exposure), 2 weeks lag	0·085	5·430	--	--
x Effect Since 2nd Wave started (October 30th)	0·036	10·382	--	--
Demographics				
Young people percentage	--	--	-0·043	-4·555
Hispanic people percentage	0·015	9·344	0·013	5·028
African American percentage	0·013	7·538	--	--
x Effect Since 2nd Wave started (October 30th)	-0·002	-2·319	--	--
Female percentage	0·129	10·639	0·206	12·038
Income inequality ratio	0·110	3·634	--	--
Health Indicators				
Ln (number of cardiovascular patients per 1000 Medicare beneficiaries)	0·372	4·353	0·887	6·721
Ln (HIV rate per 100K People)	--	--	0·346	11·304
Ln (cancer rate per 100K People)	0·397	1·897	1·228	4·044
Spatial Factors				
Region (Base: South, Mid-west, Pacific)				
West region	--	--	0·443	4·599
North East region	--	--	--	--
x Effect Since 2nd Wave started (October 30th)	0·064	1·777	--	--
Temporal Factors				
Effect Since 25th December	--	--	-0·021	-2·095
Correlations				
σ^2	1·060	49·154	1·535	37·862
ρ	0·931	468·920	0·982	325·480
Φ	0·848	260·942	0·881	267·780

** the variable is insignificant at 90% significance level.

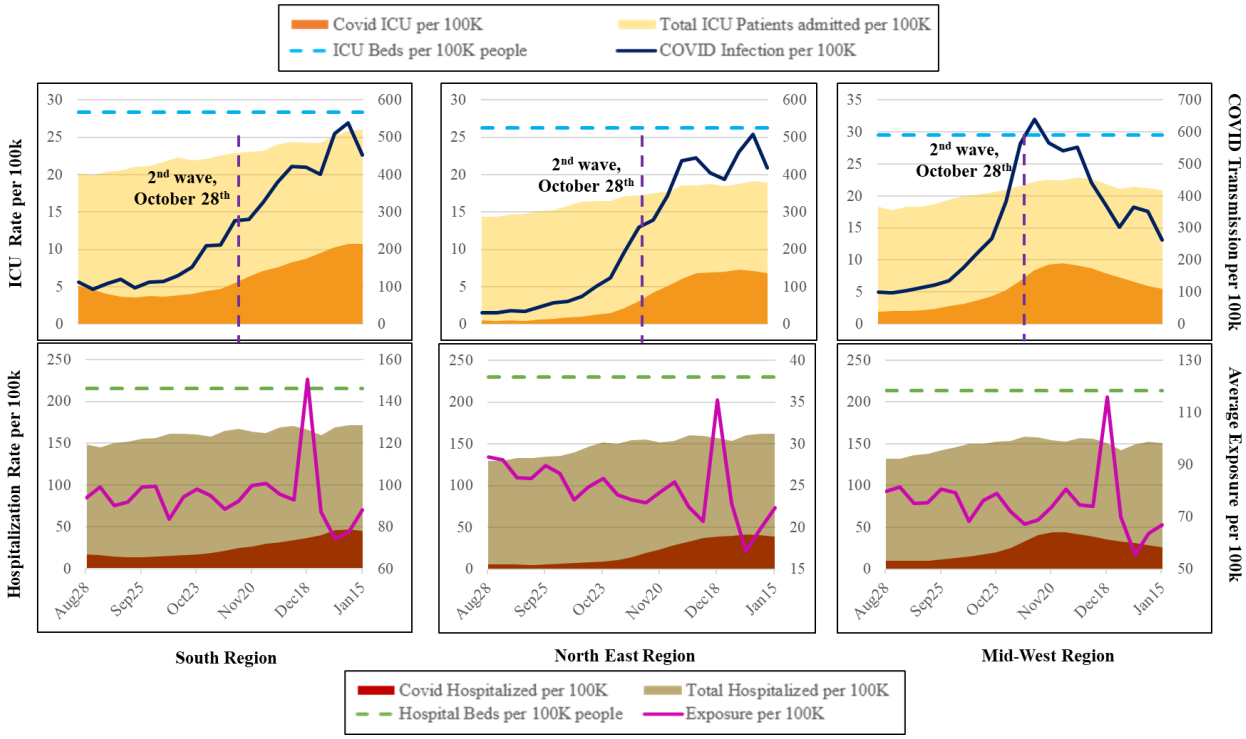

Figure A.1: A Representation of the Hospitalization Trend Across South, North-East and Mid-West region

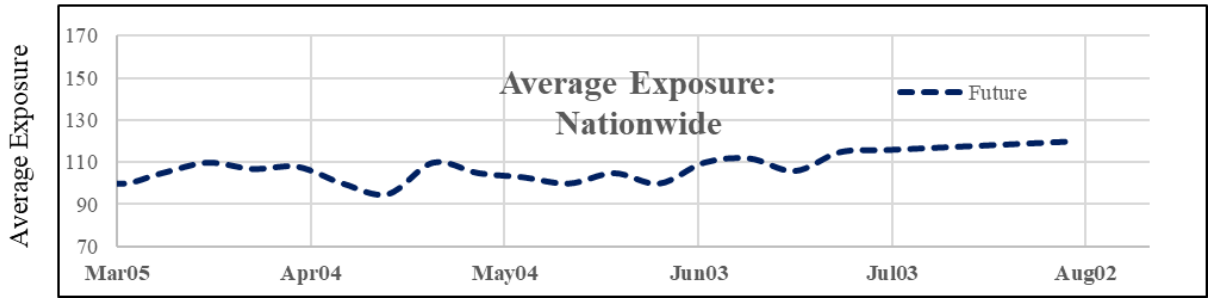

Figure A.2: Assumed Average Exposure Trend in Future

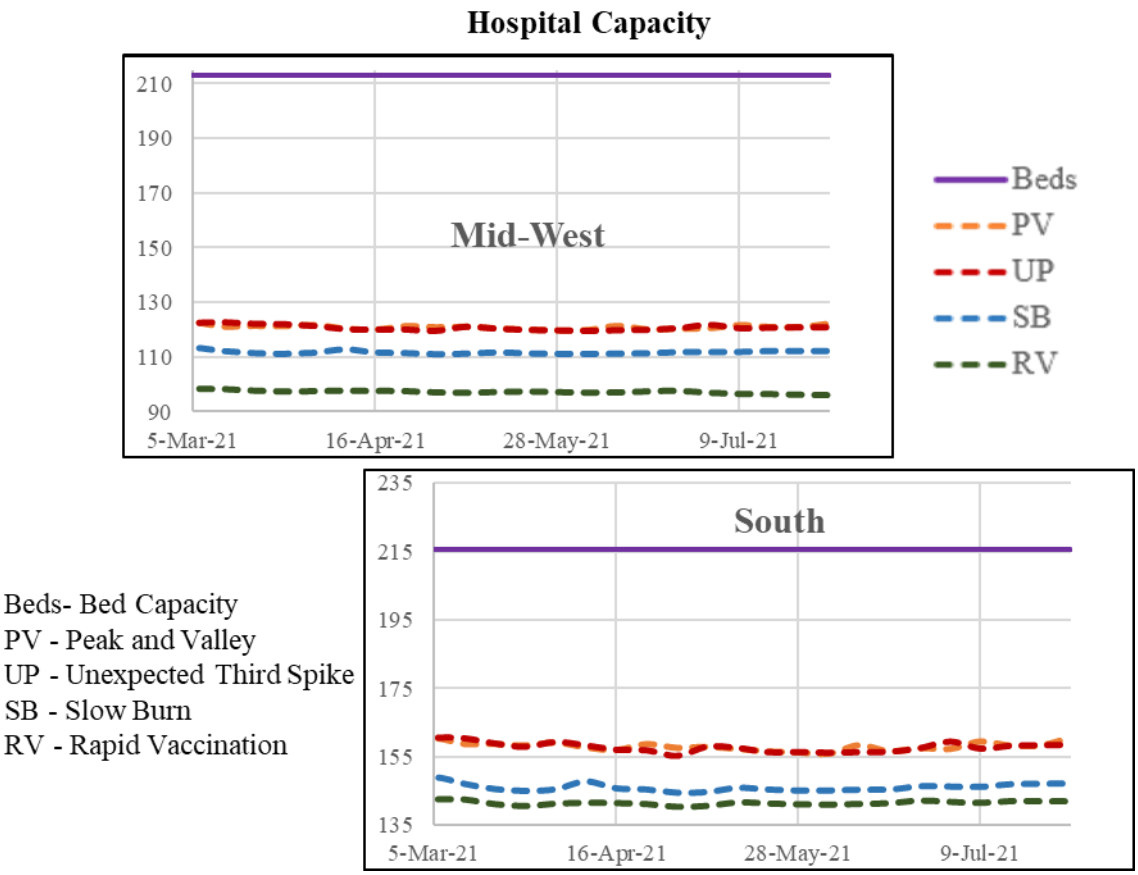

Figure A.3: Future Hospital Capacity Across Mod-West and South Regions Based on the Hypothetical Scenarios

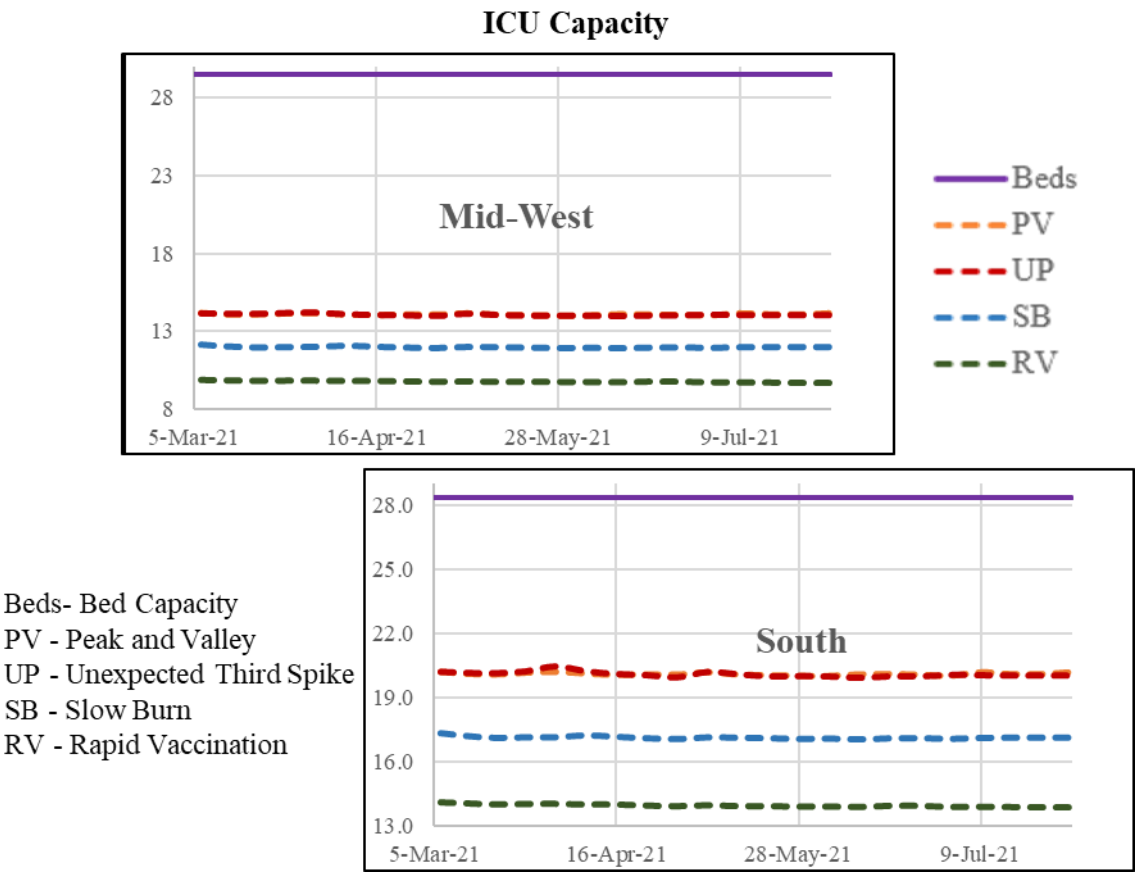

Figure A.4: Future ICU Capacity Across Mod-West and South Regions Based on the Hypothetical Scenarios

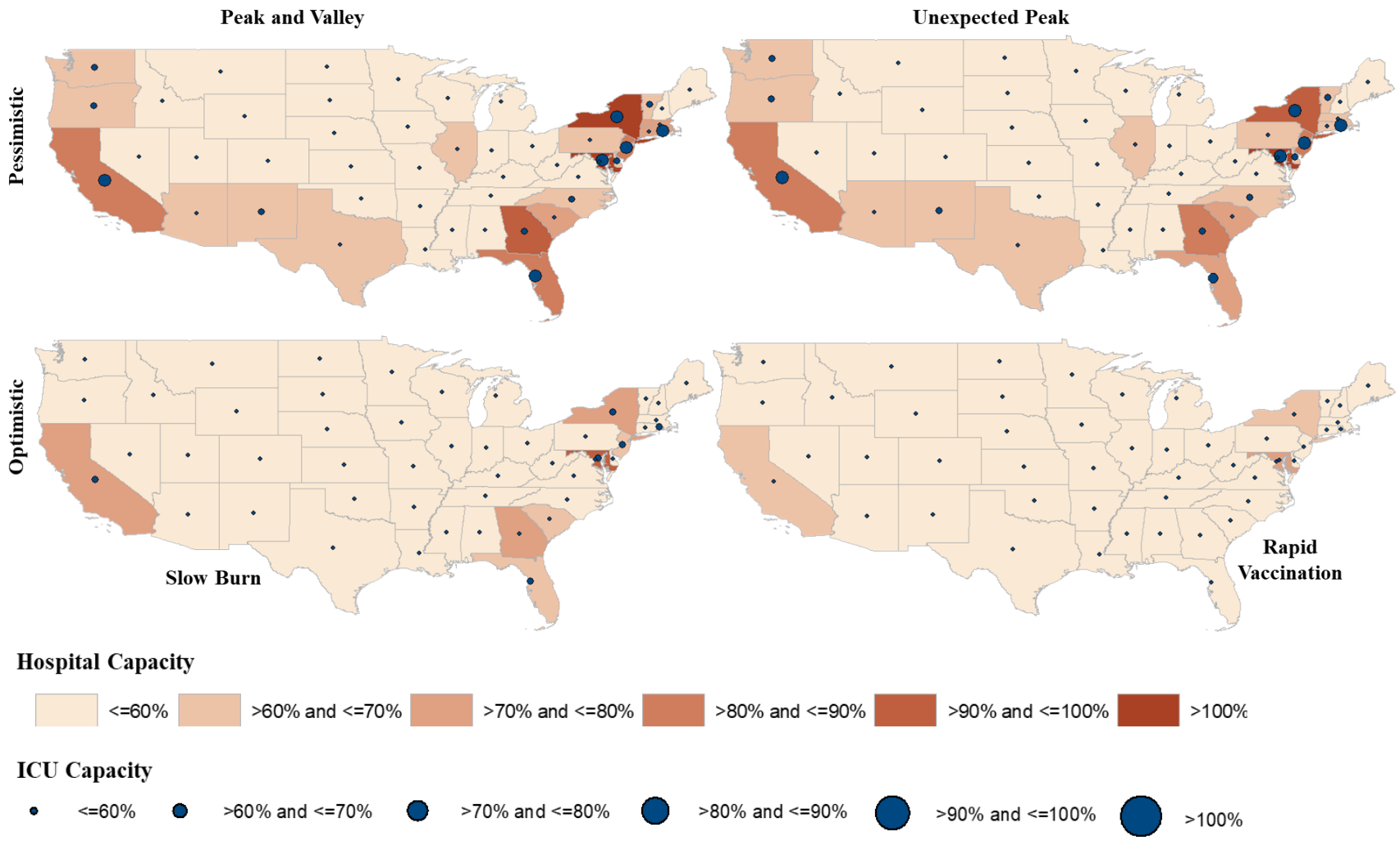

Figure A.5: Future Hospital Capacity at State level Based on the Hypothetical Scenarios