RESEARCH BRIEF

REGIONAL HEALTH SYSTEM SHORTFALLS WITH A NOVEL COVID-19 MODEL

EXECUTIVE SUMMARY

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Our ability to respond to COVID-19 depends on our health systems' capacity to serve people that are sick. And it depends on everyone's efforts to keep the number of sick people as low as possible. The fewer sick people there are at any given time, the better our health system can care for us.

Southern New Jersey's health systems serve people of all ages from rural to urban areas. Effective response to the spread of COVID-19 is contingent on many factors within our counties (Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Ocean, Salem). The Senator Walter Rand Institute for Public Affairs and the Center for Computational and Integrative Biology at Rutgers University-Camden in collaboration with New Jersey Health Initiatives explored the potential spread of COVID-19 relative to hospital capacity in southern New Jersey.

We compared estimates of available hospital beds, by county, with the likely demand for hospital beds under several virus spread scenarios. The models that generated these numbers are adaptations of the Wu et al model (2020).[i] The Wu et al model was designed for China data. Our model included additional features and fit the Italian data from "Protezione Civile".[ii]

It is best to think of the numbers reported here as one set of possible outcomes given our current knowledge about the disease. As more time passes, more people will be tested, and we will have more data to make model predictions more certain. For example, the predicted shortfalls will be less if we learn that fewer people transmit the disease before they know they are infected. Similarly, we do not know yet if warmer weather will slow the spread of COVID-19. If it does, the curve will flatten further, buying more time for social distancing efforts to impact virus spread.

Note that the main concern here is the health care system. Of those infected with COVID-19, current estimates are that 81% will not experience noticeable symptoms or mild ones. The expected hospitalization rate of those with symptoms is about 40-55%. Under even the worst case scenario, the majority of South Jerseyans will not experience symptoms from COVID-19. This report does not lead us, and should not lead anyone,

to panic. To the contrary, the report points to our ability to minimize COVID-19 risk by implementing social distancing policies and practices. We also hope that this report will help the state and health care systems as they plan to address the region's health needs.

For each county, we show:
- The number of available hospital beds.
- When we will hit peak hospital bed demand under three scenarios: 1) MINIMAL social distancing policies and practices, MODERATE social distancing policies and practices, and STRONG social distancing policies and practices to curb the spread of COVID-19.
- How much demand for hospital beds will exceed capacity under each of the three scenarios.
- The effect of social distancing practices is modeled as a change in R0. Unfortunately the disease is too new to confidently give specifics about how a particular set of policies will change the curves.
- We can say with certainty that more social distancing curbs the spread of COVID-19.
- The majority of South Jerseyans will not experience symptoms from COVID-19. Essential assets such as grocery stores, pharmacies and medical centers will almost certainly remain open and functioning.

To many people, these numbers may seem unexpectedly high. After all, the entire country of Italy had only about 21,000 cases as of March 14, 2020, and we predict a bed shortfall of at least that in South Jersey. To understand why, look at the curves on one of the county graphs. Several days ago, Italy crossed the black line where need for bed exceeds capacity. But on all the curves, the modeling suggests that there are still weeks to go before reaching the peak of the outbreak.

We also note that COVID-19 is different in several ways from the seasonal influenza. First, many people have some immunity to seasonal influenza because of vaccines or previous exposure, and current estimates suggest that no one is immune to COVID-19. Second, the coronavirus that causes COVID-19 is more contagious than the flu. Third, the current model estimates that many infected people do not show severe enough symptoms to get tested and thus may infect others. Fourth, COVID-19 seems to have higher rates of hospitalization and mortality than most seasonal influenza.
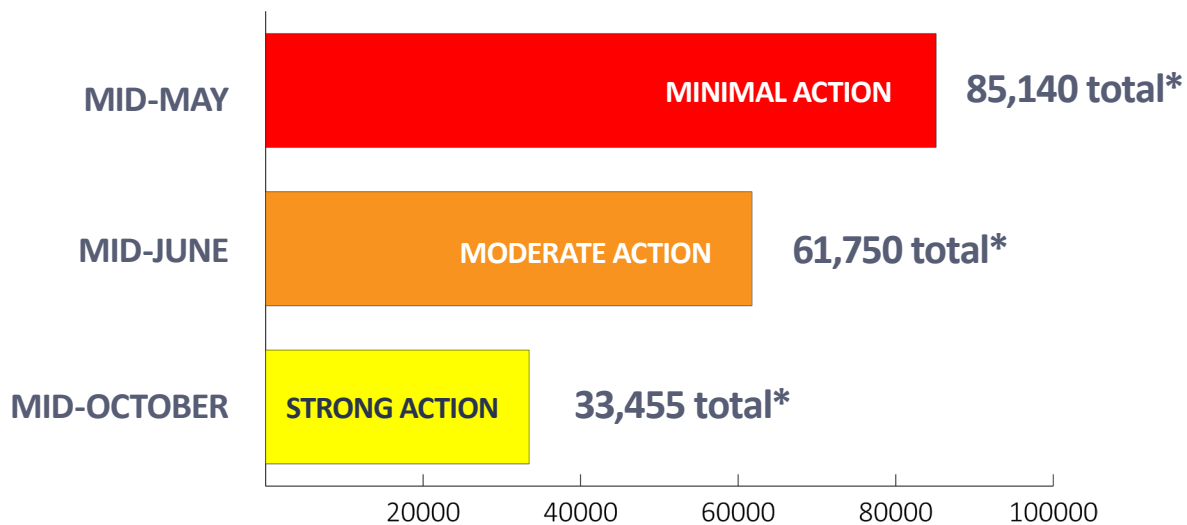
Social Distancing Policies and Practices

The term "social distancing" describes infection control actions taken by public health offices and others to stop or slow the spread of a contagious disease. Social distancing practices can prevent COVID 19's spread from overwhelming health care systems. Across the globe, various levels of social distancing policies and practices have been implemented to delay and reduce the outbreak of COVID-19.

PEAK BED SHORTFALL*

TIME TO PEAK DEMAND

* Peak bed shortfall is the # of people who cannot get a needed hospital bed at the peak of outbreak.

Time	Action	Total
MID-MAY	MINIMAL ACTION	85,140 total*
MID-JUNE	MODERATE ACTION	61,750 total*
MID-OCTOBER	STRONG ACTION	33,455 total*

(x-axis: 20000, 40000, 60000, 80000, 100000)

	MINIMAL	MODERATE	STRONG
Atlantic	9268	6699	3592
Burlington	15759	11449	6236
Camden	17644	12737	6802
Cape May	3249	2353	1270
Cumberland	5437	3976	2209
Gloucester	10386	7566	4155
Ocean	21226	15404	8361
Salem	2170	1565	832

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HOSPITAL BEDS BY COUNTY

County	Beds	County	Beds
Atlantic	800	Gloucester	426
Burlington	896	Ocean	1345
Camden	1658	Salem	222
Cape May	242		
Cumberland	100	TOTAL	5689

** Beds in each county are taken from the New Jersey Department of Health website on March 13, 2020. The number includes beds reported in profiles of General Acute Care and care-providing Special Hospital facilities.
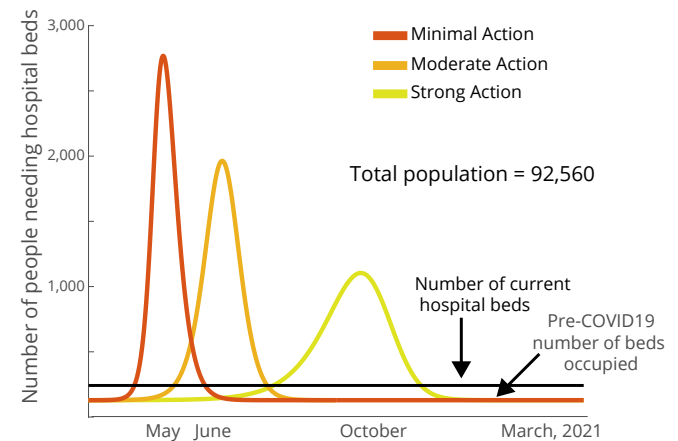
Estimated Bed Demand Over Time, Atlantic County

Total population = 265,429
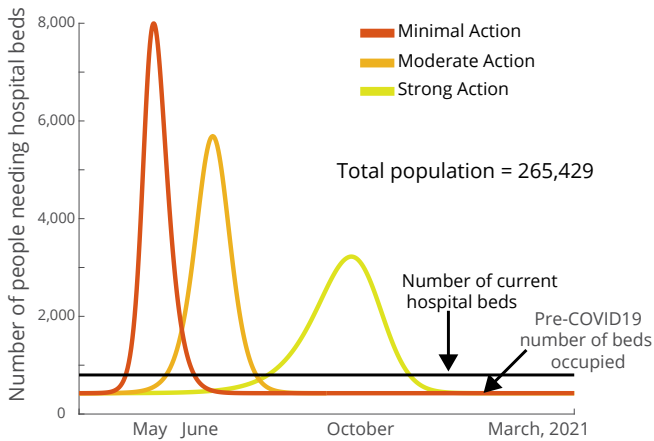
Estimated Bed Demand Over Time, Burlington County

Total population = 445,384
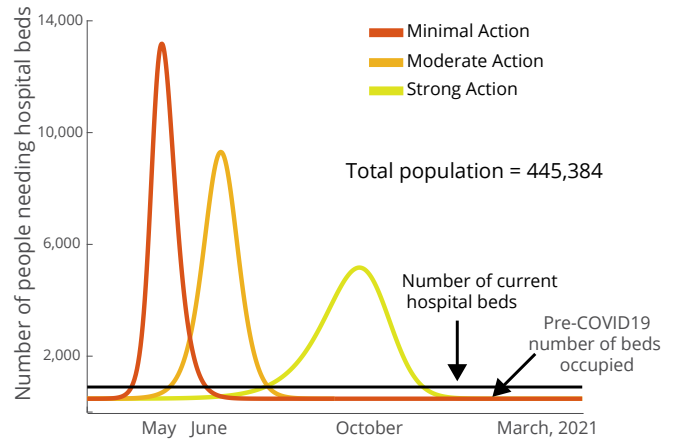
Estimated Bed Demand Over Time, Camden County

Total population = 507,078
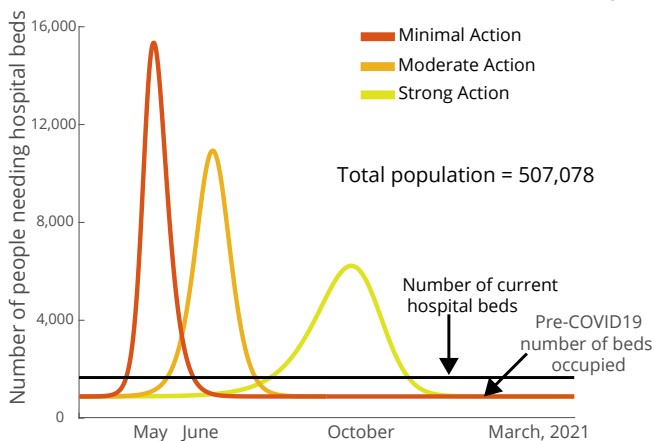
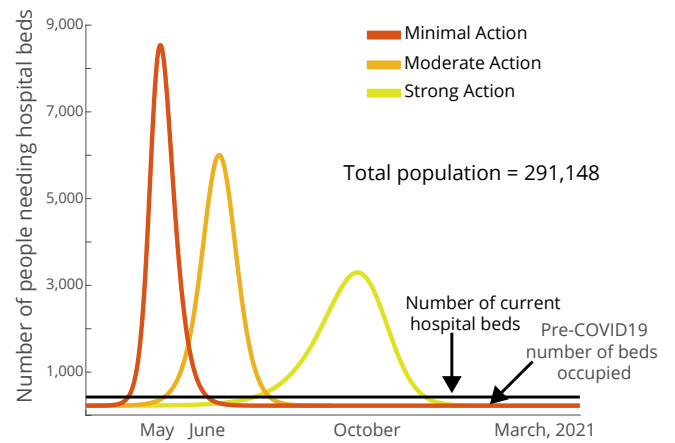## Estimated Bed Demand Over Time, Cape May County

Total population = 92,560

Due to the use of multiple models, there are small differences between the figures in the county graphs and the summary figure above.

Estimated Bed Demand Over Time, Cumberland County

Total population = 150,972
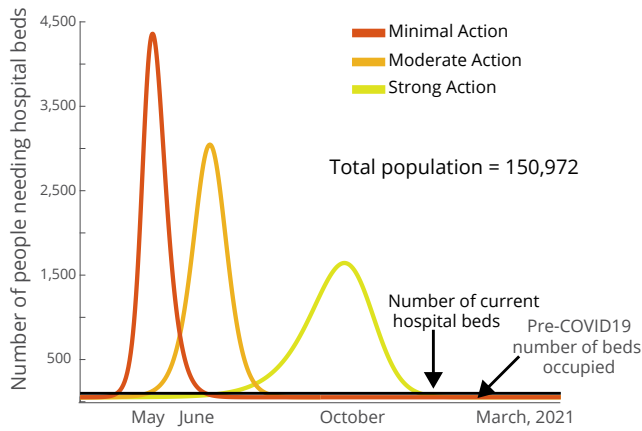
Estimated Bed Demand Over Time, Gloucester County

Total population = 291,148

Estimated Bed Demand Over Time, Ocean County

Total population = 601,151
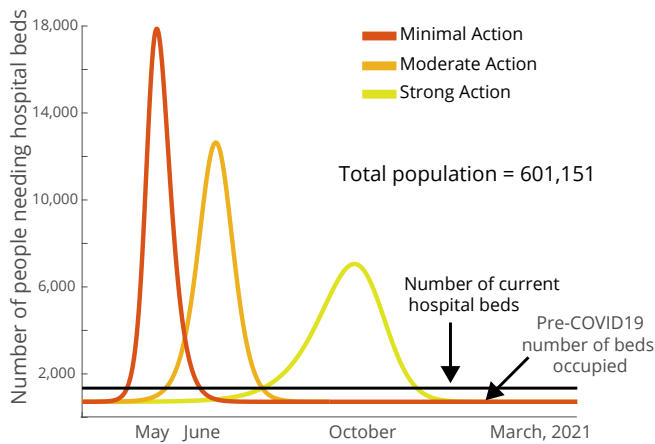
Estimated Bed Demand Over Time, Salem County
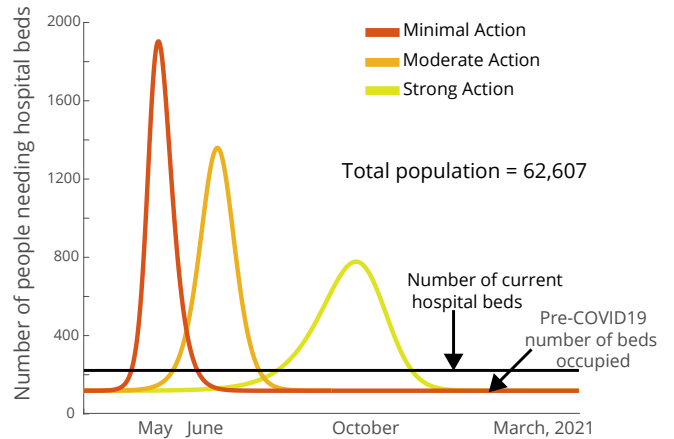
Total population = 62,607

Due to the use of multiple models, there are small differences between the figures in the county graphs and the summary figure above.

[i] *Nowcasting and forecasting the potential domestic and international spread of the 2019-nCoV outbreak originating in Wuhan, China: a modelling study by Joseph T Wu*, Kathy Leung*, Gabriel M Leung. Lancet 2020; 395: 689–97, Published Online January 31 2020, https://doi.org/10.1016/ S0140-6736(20) 30260-9.

[ii] Link to Protezione Civile data: https://github.com/pcm-dpc/COVID-19/blob/master/schede-riepilogative/regioni/dpc-covid19-ita-scheda-regioni-20200302.pdf

Senator Walter Rand Institute for Public Affairs (WRI) is an applied research and public service center at Rutgers University-Camden working to address issues impacting residents and communities in southern New Jersey. With two decades of experience in evaluation, public policy, and organizational development, WRI has helped organizations in the public, private, and nonprofit sectors develop partnerships and achieve optimal effectiveness. WRI aims to contribute knowledge for sound policy and practice in South Jersey through research, community engagement, and coalition building.

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