IEM's AI Modeling: Short-term COVID-19 Projections

Date: 1/7/21

Leveraging over 15 years of support to HHS for medical consequence modeling and our proprietary artificial intelligence (AI) models, IEM believes that our Coronavirus model outputs can be used to assist localities and their medical facilities to better prepare for an increase in hospitalizations, to better plan for and locate drive-through testing facilities, and to determine where increased levels of transmission may be occurring.

We have been refining our AI model over the past month and are confident in its ability to provide accurate 7-day projections that can be used for operational and logistical planning.

AI-based Model Background

IEM is currently using an AI model to fit data from various sources and project new cases of COVID-19. We do not assume the average number of secondary infections (R-value) stays the same over time. IEM's AI model finds the best R-value over time to evaluate how it changes over the course of the outbreak. The IEM modeling team is running ~11 million simulations to fit each state's data and using the best fit for the R-value to project new cases over the next 7 days. The AI models are executed on a daily basis to evaluate the changing dynamics of the COVID-19 pandemic. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 1/7/21 9 a.m.

Please provide any feedback or send any questions that you might have to us. We are continually updating and improving the model, so your feedback is critical.

Also, if you have more current or refined data for your State, Commonwealth or Territory that you would like IEM to factor in, please let us know.

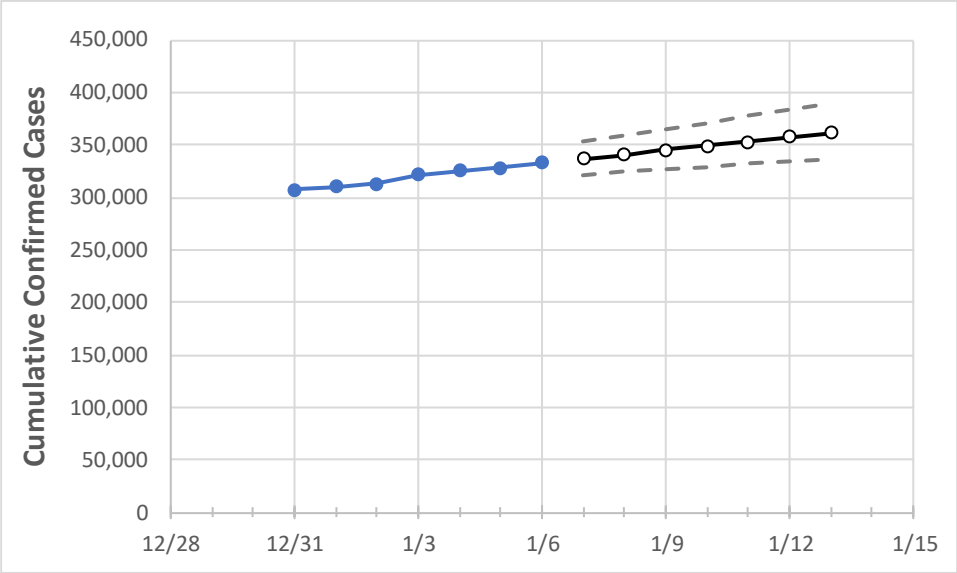
IEM's Modeling Lead

Dr. Prasith "Sid" Baccam is a **Computational Epidemiologist expert** at IEM with more than **20 years of experience in medical consequence modeling and simulation of disease outbreaks** and medical consequences following hypothetical attacks with biological agents or emerging infectious diseases. He develops key simulation models and decision support tools at IEM, specializing in public health, disaster response, and medical countermeasures (MCM) to enhance data-driven decision making and improve modeling assumptions.

Upon receiving his **Ph.D. in Applied Mathematics and Immunobiology** at Iowa State University, Dr. Baccam worked as a Postdoctoral Research Associate at Los Alamos National Laboratory where he focused on researching viral and immunological modeling. After his stint at Los Alamos, Dr. Baccam has served as Task Lead in multiple public health projects have allowed him to develop expertise as a mathematical biologist and a leader on high-performance modeling and simulation teams.

He has worked with state and local public health officials as well as Federal agencies, including **HHS**, the Centers for Disease Control and Prevention (**CDC**), and the Department of Homeland Security (**DHS**). Dr. Baccam has published numerous papers on public health response models and implications on policy and has been invited to participate in workshops and symposiums held by the Institute of Medicine (now the National Academy of Health). His modeling results have been briefed to the **Executive Office of the President** and informed two presidential policy actions.

South Carolina State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13
South Carolina	321,669	325,472	328,073	333,235	336,996	340,846	344,937	348,873	352,965	357,234	361,182

Note: The State's projection shows a "best estimate" curve (the solid line with circles) and the dotted lines are the upper and lower estimates around that best estimate. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

South Carolina Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13
Beaufort	10,028	10,082	10,114	10,263	10,374	10,485	10,598	10,716	10,838	10,963	11,091
Charleston	24,886	25,041	25,145	25,421	25,613	25,804	26,004	26,207	26,414	26,623	26,841
Greenville	39,777	40,362	40,778	41,627	42,232	42,846	43,478	44,121	44,771	45,443	46,140
Kershaw	4,050	4,076	4,130	4,196	4,244	4,296	4,350	4,405	4,463	4,523	4,584
Lexington	17,480	17,744	17,917	18,248	18,498	18,753	19,007	19,275	19,545	19,824	20,101
Richland	27,127	27,442	27,568	27,983	28,243	28,508	28,780	29,060	29,348	29,638	29,937
Spartanburg	20,769	21,173	21,315	21,692	21,957	22,235	22,511	22,797	23,080	23,356	23,651
York	16,149	16,288	16,436	16,725	16,951	17,170	17,401	17,636	17,871	18,110	18,355

Some recipients of our daily COVID-19 short-term (7 day) projections have requested projections of demand for: hospital bed, intensive care unit (ICU) beds, and mechanical ventilation. We realize that different states and localities will have different characteristics for hospital demand of COVID-19 cases, and we are presenting the best assumptions we could find for those medical demands based on scientific literature and health data reporting. Specifically:

- *Beds: For hospitalization, we use a range of 10% and 20% of cases require hospitalization based on CDC's report (MMWR, March 18, 2020) and state reports of COVID-19 cases.*
- *ICU: The CDC report found that 24% of hospitalized cases require ICU care.*
- *Ventilators: Based on clinical data from China and state reports, we assume that 50% of ICU cases require a ventilator.*

If you have other estimates for these assumptions, please share them with us as we work to refine our modeling, assumptions, and data on a daily basis.

*The medical demands shown in the table assume 20% of **cumulative** confirmed cases require hospitalization. To get the medical demand for the assumption that 10% of confirmed cases require hospitalization, simply divide the demand by 2.*

South Carolina Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	1/3	1/4	1/5	1/6	1/8	1/10	1/12
Beaufort	10,028	10,082	10,114	10,263	10,485 (2,097) [503] {252}	10,716 (2,143) [514] {257}	10,963 (2,193) [526] {263}
Charleston	24,886	25,041	25,145	25,421	25,804 (5,161) [1,239] {619}	26,207 (5,241) [1,258] {629}	26,623 (5,325) [1,278] {639}
Greenville	39,777	40,362	40,778	41,627	42,846 (8,569) [2,057] {1,028}	44,121 (8,824) [2,118] {1,059}	45,443 (9,089) [2,181] {1,091}
Kershaw	4,050	4,076	4,130	4,196	4,296 (859) [206] {103}	4,405 (881) [211] {106}	4,523 (905) [217] {109}
Lexington	17,480	17,744	17,917	18,248	18,753 (3,751) [900] {450}	19,275 (3,855) [925] {463}	19,824 (3,965) [952] {476}
Richland	27,127	27,442	27,568	27,983	28,508 (5,702) [1,368] {684}	29,060 (5,812) [1,395] {697}	29,638 (5,928) [1,423] {711}
Spartanburg	20,769	21,173	21,315	21,692	22,235 (4,447) [1,067] {534}	22,797 (4,559) [1,094] {547}	23,356 (4,671) [1,121] {561}
York	16,149	16,288	16,436	16,725	17,170 (3,434) [824] {412}	17,636 (3,527) [847] {423}	18,110 (3,622) [869] {435}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.