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

Date: 1/14/21

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 1/14/21 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.

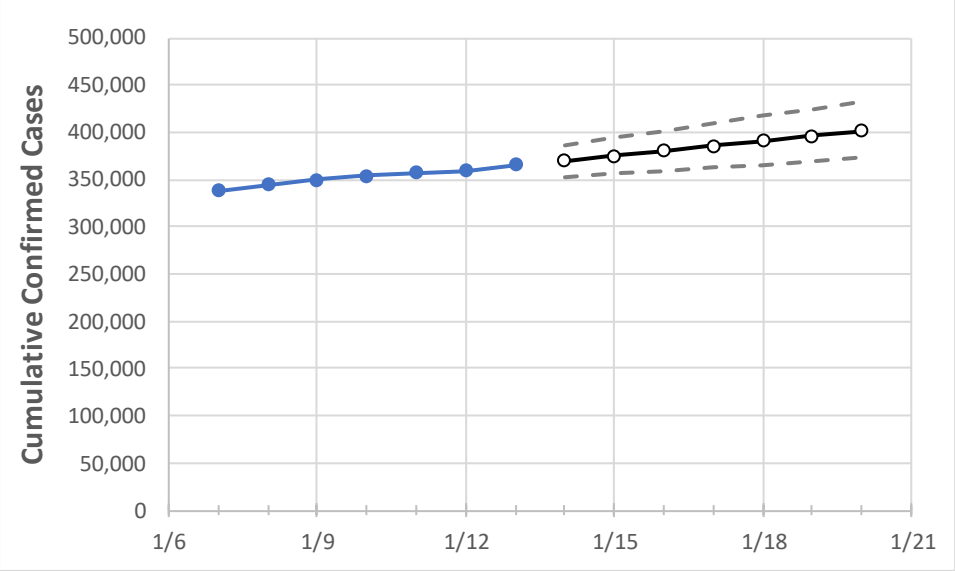
IEM's Modeling Lead

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:						
	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19	1/20
South Carolina	354,525	357,654	359,357	365,378	370,218	375,300	380,369	385,663	390,972	396,445	401,927

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:						
	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19	1/20
Beaufort	10,915	10,958	11,005	11,157	11,294	11,434	11,577	11,727	11,879	12,026	12,184
Charleston	26,967	27,180	27,255	27,591	27,918	28,255	28,605	28,967	29,361	29,744	30,154
Greenville	44,698	45,085	45,252	46,101	46,813	47,522	48,255	49,016	49,767	50,557	51,326
Kershaw	4,392	4,425	4,453	4,553	4,613	4,674	4,738	4,803	4,870	4,940	5,013
Lexington	19,622	19,795	19,870	20,268	20,563	20,864	21,168	21,484	21,807	22,115	22,451
Richland	29,345	29,571	29,637	29,965	30,281	30,600	30,933	31,270	31,596	31,936	32,289
Spartanburg	23,119	23,360	23,445	23,787	24,096	24,410	24,738	25,068	25,412	25,744	26,087
York	17,788	17,911	17,974	18,329	18,585	18,836	19,109	19,376	19,647	19,932	20,215

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:		
	1/10	1/11	1/12	1/13	1/15	1/17	1/19
Beaufort	10,915	10,958	11,005	11,157	11,434 (2,287) [549] {274}	11,727 (2,345) [563] {281}	12,026 (2,405) [577] {289}
Charleston	26,967	27,180	27,255	27,591	28,255 (5,651) [1,356] {678}	28,967 (5,793) [1,390] {695}	29,744 (5,949) [1,428] {714}
Greenville	44,698	45,085	45,252	46,101	47,522 (9,504) [2,281] {1,141}	49,016 (9,803) [2,353] {1,176}	50,557 (10,111) [2,427] {1,213}
Kershaw	4,392	4,425	4,453	4,553	4,674 (935) [224] {112}	4,803 (961) [231] {115}	4,940 (988) [237] {119}
Lexington	19,622	19,795	19,870	20,268	20,864 (4,173) [1,001] {501}	21,484 (4,297) [1,031] {516}	22,115 (4,423) [1,062] {531}
Richland	29,345	29,571	29,637	29,965	30,600 (6,120) [1,469] {734}	31,270 (6,254) [1,501] {750}	31,936 (6,387) [1,533] {766}
Spartanburg	23,119	23,360	23,445	23,787	24,410 (4,882) [1,172] {586}	25,068 (5,014) [1,203] {602}	25,744 (5,149) [1,236] {618}
York	17,788	17,911	17,974	18,329	18,836 (3,767) [904] {452}	19,376 (3,875) [930] {465}	19,932 (3,986) [957] {478}

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.