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

Date: 11/19/21

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 11/19/21 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.

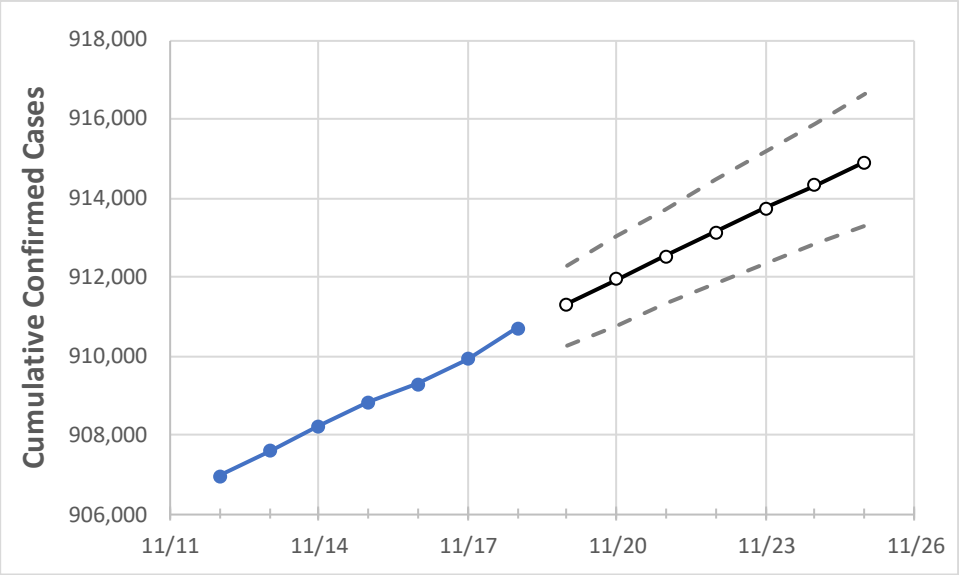
IEM's Modeling Lead

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:						
	11/15	11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23	11/24	11/25
South Carolina	908,839	909,288	909,905	910,690	911,311	911,929	912,528	913,121	913,728	914,319	914,907

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:						
	11/15	11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23	11/24	11/25
Beaufort	27,455	27,464	27,485	27,496	27,507	27,517	27,528	27,538	27,548	27,558	27,567
Charleston	66,006	66,039	66,071	66,122	66,165	66,208	66,248	66,289	66,331	66,372	66,411
Greenville	106,556	106,619	106,670	106,768	106,845	106,921	106,996	107,072	107,146	107,221	107,294
Kershaw	12,124	12,131	12,137	12,150	12,157	12,165	12,172	12,179	12,186	12,194	12,200
Lexington	54,913	54,945	54,956	54,993	55,023	55,054	55,084	55,114	55,144	55,173	55,203
Richland	69,692	69,719	69,725	69,802	69,839	69,873	69,909	69,944	69,978	70,014	70,046
Spartanburg	62,557	62,587	62,623	62,667	62,703	62,741	62,777	62,813	62,846	62,883	62,917
York	47,523	47,560	47,623	47,652	47,702	47,751	47,800	47,849	47,899	47,950	48,000

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:		
	11/15	11/16	11/17	11/18	11/20	11/22	11/24
Beaufort	27,455	27,464	27,485	27,496	27,517 (5,503) [1,321] {660}	27,538 (5,508) [1,322] {661}	27,558 (5,512) [1,323] {661}
Charleston	66,006	66,039	66,071	66,122	66,208 (13,242) [3,178] {1,589}	66,289 (13,258) [3,182] {1,591}	66,372 (13,274) [3,186] {1,593}
Greenville	106,556	106,619	106,670	106,768	106,921 (21,384) [5,132] {2,566}	107,072 (21,414) [5,139] {2,570}	107,221 (21,444) [5,147] {2,573}
Kershaw	12,124	12,131	12,137	12,150	12,165 (2,433) [584] {292}	12,179 (2,436) [585] {292}	12,194 (2,439) [585] {293}
Lexington	54,913	54,945	54,956	54,993	55,054 (11,011) [2,643] {1,321}	55,114 (11,023) [2,645] {1,323}	55,173 (11,035) [2,648] {1,324}
Richland	69,692	69,719	69,725	69,802	69,873 (13,975) [3,354] {1,677}	69,944 (13,989) [3,357] {1,679}	70,014 (14,003) [3,361] {1,680}
Spartanburg	62,557	62,587	62,623	62,667	62,741 (12,548) [3,012] {1,506}	62,813 (12,563) [3,015] {1,508}	62,883 (12,577) [3,018] {1,509}
York	47,523	47,560	47,623	47,652	47,751 (9,550) [2,292] {1,146}	47,849 (9,570) [2,297] {1,148}	47,950 (9,590) [2,302] {1,151}

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.