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

Date: 12/6/21

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 12/6/21 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.

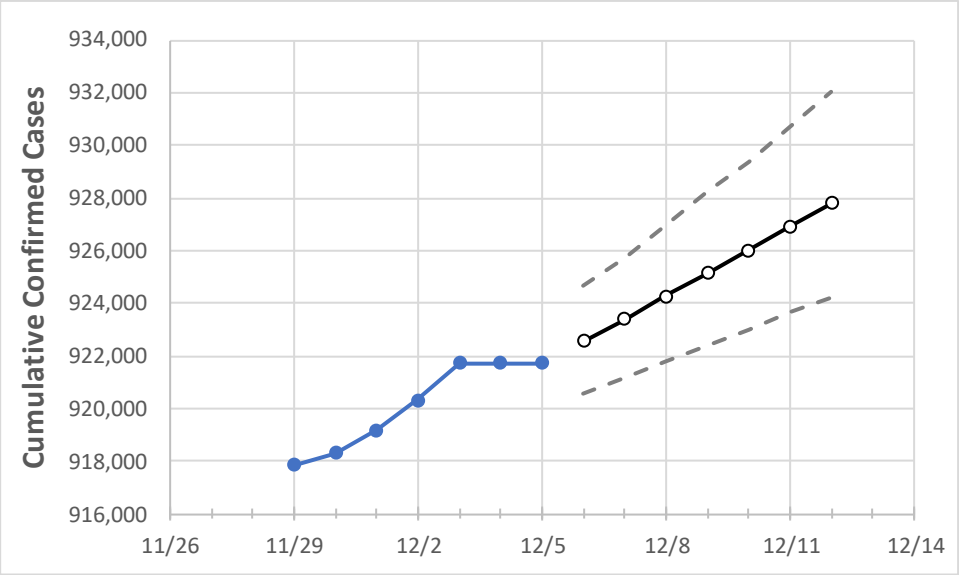
IEM's Modeling Lead

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:						
	12/2	12/3	12/4	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12
South Carolina	920,311	921,722	921,722	921,722	922,562	923,398	924,278	925,139	926,014	926,922	927,794

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:						
	12/2	12/3	12/4	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12
Beaufort	27,693	27,718	27,718	27,718	27,734	27,750	27,765	27,782	27,799	27,816	27,833
Charleston	66,802	66,882	66,882	66,882	66,936	66,989	67,044	67,100	67,153	67,209	67,266
Greenville	107,942	108,113	108,113	108,113	108,198	108,281	108,367	108,455	108,535	108,625	108,707
Kershaw	12,295	12,334	12,334	12,334	12,352	12,373	12,392	12,413	12,432	12,456	12,480
Lexington	55,638	55,713	55,713	55,713	55,777	55,844	55,911	55,979	56,051	56,122	56,197
Richland	70,359	70,437	70,437	70,437	70,475	70,514	70,552	70,591	70,630	70,670	70,711
Spartanburg	63,308	63,407	63,407	63,407	63,459	63,509	63,561	63,612	63,667	63,721	63,775
York	48,358	48,470	48,470	48,470	48,528	48,586	48,651	48,708	48,772	48,836	48,898

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:		
	12/2	12/3	12/4	12/5	12/7	12/9	12/11
Beaufort	27,693	27,718	27,718	27,718	27,750 (5,550) [1,332] {666}	27,782 (5,556) [1,334] {667}	27,816 (5,563) [1,335] {668}
Charleston	66,802	66,882	66,882	66,882	66,989 (13,398) [3,215] {1,608}	67,100 (13,420) [3,221] {1,610}	67,209 (13,442) [3,226] {1,613}
Greenville	107,942	108,113	108,113	108,113	108,281 (21,656) [5,198] {2,599}	108,455 (21,691) [5,206] {2,603}	108,625 (21,725) [5,214] {2,607}
Kershaw	12,295	12,334	12,334	12,334	12,373 (2,475) [594] {297}	12,413 (2,483) [596] {298}	12,456 (2,491) [598] {299}
Lexington	55,638	55,713	55,713	55,713	55,844 (11,169) [2,681] {1,340}	55,979 (11,196) [2,687] {1,343}	56,122 (11,224) [2,694] {1,347}
Richland	70,359	70,437	70,437	70,437	70,514 (14,103) [3,385] {1,692}	70,591 (14,118) [3,388] {1,694}	70,670 (14,134) [3,392] {1,696}
Spartanburg	63,308	63,407	63,407	63,407	63,509 (12,702) [3,048] {1,524}	63,612 (12,722) [3,053] {1,527}	63,721 (12,744) [3,059] {1,529}
York	48,358	48,470	48,470	48,470	48,586 (9,717) [2,332] {1,166}	48,708 (9,742) [2,338] {1,169}	48,836 (9,767) [2,344] {1,172}

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.