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

Date: 12/7/20

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 12/7/20 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.

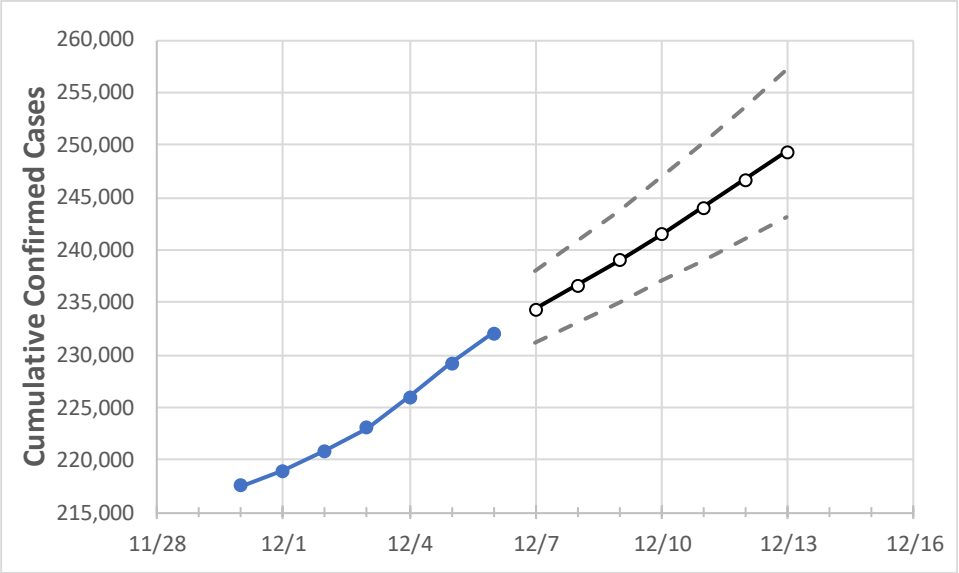
IEM's Modeling Lead

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:						
	12/3	12/4	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13
South Carolina	223,063	226,013	229,235	232,099	234,319	236,618	238,998	241,460	244,008	246,644	249,371

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 20%, and are often within 10%, of actual confirmed cases.

South Carolina Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	12/3	12/4	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13
Beaufort	7,298	7,372	7,451	7,519	7,571	7,624	7,679	7,737	7,796	7,857	7,920
Charleston	20,312	20,459	20,667	20,783	20,899	21,017	21,138	21,261	21,386	21,514	21,643
Greenville	24,728	25,160	25,617	25,990	26,291	26,602	26,922	27,251	27,591	27,941	28,301
Kershaw	3,014	3,033	3,075	3,107	3,126	3,146	3,166	3,187	3,208	3,231	3,254
Lexington	11,722	11,894	12,029	12,199	12,305	12,413	12,525	12,640	12,758	12,879	13,004
Richland	20,890	21,090	21,332	21,507	21,654	21,805	21,961	22,121	22,285	22,455	22,629
Spartanburg	12,920	13,247	13,503	13,790	13,978	14,173	14,376	14,587	14,807	15,036	15,274
York	10,201	10,387	10,553	10,840	10,995	11,154	11,319	11,489	11,665	11,847	12,034

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:		
	12/3	12/4	12/5	12/6	12/8	12/10	12/12
Beaufort	7,298	7,372	7,451	7,519	7,624 (1,525) [366] {183}	7,737 (1,547) [371] {186}	7,857 (1,571) [377] {189}
Charleston	20,312	20,459	20,667	20,783	21,017 (4,203) [1,009] {504}	21,261 (4,252) [1,021] {510}	21,514 (4,303) [1,033] {516}
Greenville	24,728	25,160	25,617	25,990	26,602 (5,320) [1,277] {638}	27,251 (5,450) [1,308] {654}	27,941 (5,588) [1,341] {671}
Kershaw	3,014	3,033	3,075	3,107	3,146 (629) [151] {75}	3,187 (637) [153] {76}	3,231 (646) [155] {78}
Lexington	11,722	11,894	12,029	12,199	12,413 (2,483) [596] {298}	12,640 (2,528) [607] {303}	12,879 (2,576) [618] {309}
Richland	20,890	21,090	21,332	21,507	21,805 (4,361) [1,047] {523}	22,121 (4,424) [1,062] {531}	22,455 (4,491) [1,078] {539}
Spartanburg	12,920	13,247	13,503	13,790	14,173 (2,835) [680] {340}	14,587 (2,917) [700] {350}	15,036 (3,007) [722] {361}
York	10,201	10,387	10,553	10,840	11,154 (2,231) [535] {268}	11,489 (2,298) [551] {276}	11,847 (2,369) [569] {284}

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.