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

Date: 2/4/21

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 2/4/21 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.

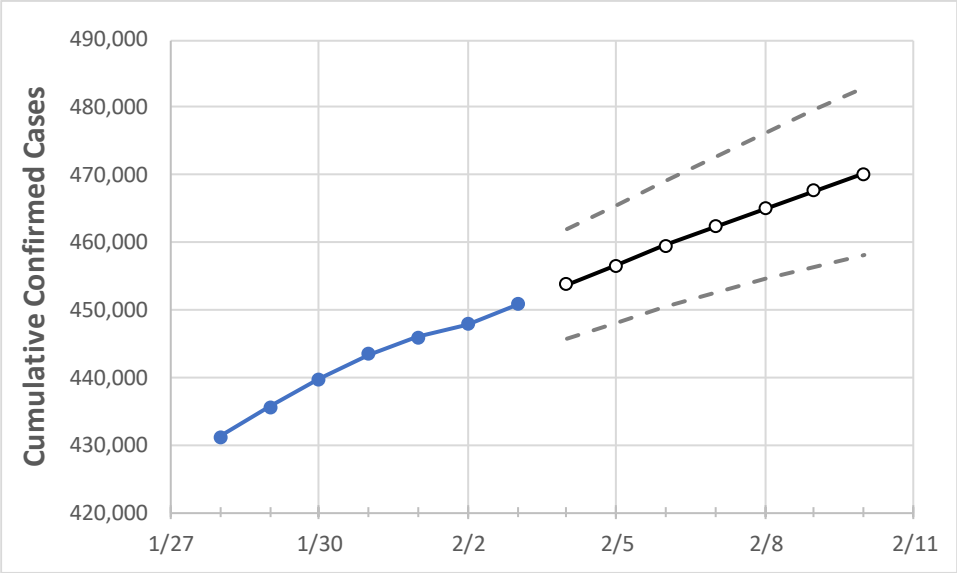
IEM's Modeling Lead

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:						
	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8	2/9	2/10
South Carolina	443,386	445,916	447,904	450,794	453,717	456,649	459,533	462,272	465,015	467,625	470,164

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:						
	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8	2/9	2/10
Beaufort	13,487	13,586	13,644	13,719	13,814	13,911	14,006	14,099	14,193	14,284	14,377
Charleston	32,837	33,059	33,254	33,516	33,776	34,035	34,294	34,554	34,815	35,070	35,324
Greenville	55,887	56,186	56,352	56,779	57,125	57,473	57,800	58,120	58,426	58,722	59,023
Kershaw	5,592	5,626	5,645	5,701	5,749	5,797	5,846	5,893	5,940	5,987	6,034
Lexington	24,661	24,773	24,926	25,077	25,235	25,387	25,536	25,680	25,829	25,964	26,096
Richland	35,846	36,015	36,169	36,340	36,580	36,823	37,068	37,306	37,534	37,765	37,991
Spartanburg	29,901	30,059	30,215	30,405	30,635	30,853	31,072	31,277	31,484	31,680	31,876
York	22,190	22,362	22,501	22,640	22,793	22,942	23,086	23,228	23,361	23,495	23,630

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:		
	1/31	2/1	2/2	2/3	2/5	2/7	2/9
Beaufort	13,487	13,586	13,644	13,719	13,911 (2,782) [668] {334}	14,099 (2,820) [677] {338}	14,284 (2,857) [686] {343}
Charleston	32,837	33,059	33,254	33,516	34,035 (6,807) [1,634] {817}	34,554 (6,911) [1,659] {829}	35,070 (7,014) [1,683] {842}
Greenville	55,887	56,186	56,352	56,779	57,473 (11,495) [2,759] {1,379}	58,120 (11,624) [2,790] {1,395}	58,722 (11,744) [2,819] {1,409}
Kershaw	5,592	5,626	5,645	5,701	5,797 (1,159) [278] {139}	5,893 (1,179) [283] {141}	5,987 (1,197) [287] {144}
Lexington	24,661	24,773	24,926	25,077	25,387 (5,077) [1,219] {609}	25,680 (5,136) [1,233] {616}	25,964 (5,193) [1,246] {623}
Richland	35,846	36,015	36,169	36,340	36,823 (7,365) [1,768] {884}	37,306 (7,461) [1,791] {895}	37,765 (7,553) [1,813] {906}
Spartanburg	29,901	30,059	30,215	30,405	30,853 (6,171) [1,481] {740}	31,277 (6,255) [1,501] {751}	31,680 (6,336) [1,521] {760}
York	22,190	22,362	22,501	22,640	22,942 (4,588) [1,101] {551}	23,228 (4,646) [1,115] {557}	23,495 (4,699) [1,128] {564}

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.