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

Date: 9/3/21

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 9/3/21 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.

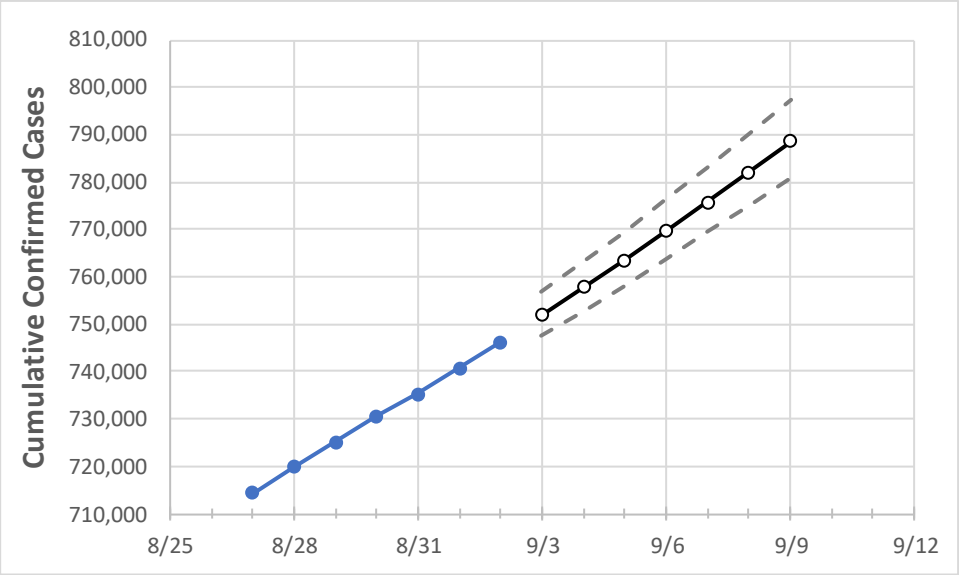
IEM's Modeling Lead

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:						
	8/30	8/31	9/1	9/2	9/3	9/4	9/5	9/6	9/7	9/8	9/9
South Carolina	730,685	735,287	740,634	746,157	751,914	757,745	763,594	769,653	775,826	782,128	788,657

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:						
	8/30	8/31	9/1	9/2	9/3	9/4	9/5	9/6	9/7	9/8	9/9
Beaufort	22,912	23,077	23,285	23,432	23,612	23,792	23,972	24,154	24,331	24,520	24,700
Charleston	55,297	55,647	56,013	56,430	56,861	57,297	57,735	58,187	58,635	59,092	59,564
Greenville	86,779	87,177	87,633	88,141	88,671	89,217	89,768	90,332	90,916	91,509	92,121
Kershaw	9,772	9,812	9,872	9,928	9,992	10,056	10,119	10,183	10,248	10,312	10,377
Lexington	44,137	44,419	44,733	45,150	45,543	45,941	46,353	46,767	47,185	47,616	48,046
Richland	57,985	58,184	58,543	58,850	59,173	59,498	59,831	60,160	60,496	60,835	61,173
Spartanburg	49,215	49,478	49,874	50,132	50,483	50,841	51,202	51,585	51,973	52,377	52,787
York	38,251	38,473	38,681	38,994	39,259	39,532	39,806	40,093	40,382	40,689	40,996

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:		
	8/30	8/31	9/1	9/2	9/4	9/6	9/8
Beaufort	22,912	23,077	23,285	23,432	23,792 (4,758) [1,142] {571}	24,154 (4,831) [1,159] {580}	24,520 (4,904) [1,177] {588}
Charleston	55,297	55,647	56,013	56,430	57,297 (11,459) [2,750] {1,375}	58,187 (11,637) [2,793] {1,396}	59,092 (11,818) [2,836] {1,418}
Greenville	86,779	87,177	87,633	88,141	89,217 (17,843) [4,282] {2,141}	90,332 (18,066) [4,336] {2,168}	91,509 (18,302) [4,392] {2,196}
Kershaw	9,772	9,812	9,872	9,928	10,056 (2,011) [483] {241}	10,183 (2,037) [489] {244}	10,312 (2,062) [495] {247}
Lexington	44,137	44,419	44,733	45,150	45,941 (9,188) [2,205] {1,103}	46,767 (9,353) [2,245] {1,122}	47,616 (9,523) [2,286] {1,143}
Richland	57,985	58,184	58,543	58,850	59,498 (11,900) [2,856] {1,428}	60,160 (12,032) [2,888] {1,444}	60,835 (12,167) [2,920] {1,460}
Spartanburg	49,215	49,478	49,874	50,132	50,841 (10,168) [2,440] {1,220}	51,585 (10,317) [2,476] {1,238}	52,377 (10,475) [2,514] {1,257}
York	38,251	38,473	38,681	38,994	39,532 (7,906) [1,898] {949}	40,093 (8,019) [1,924] {962}	40,689 (8,138) [1,953] {977}

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.