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

Date: 9/8/21

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 9/8/21 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.

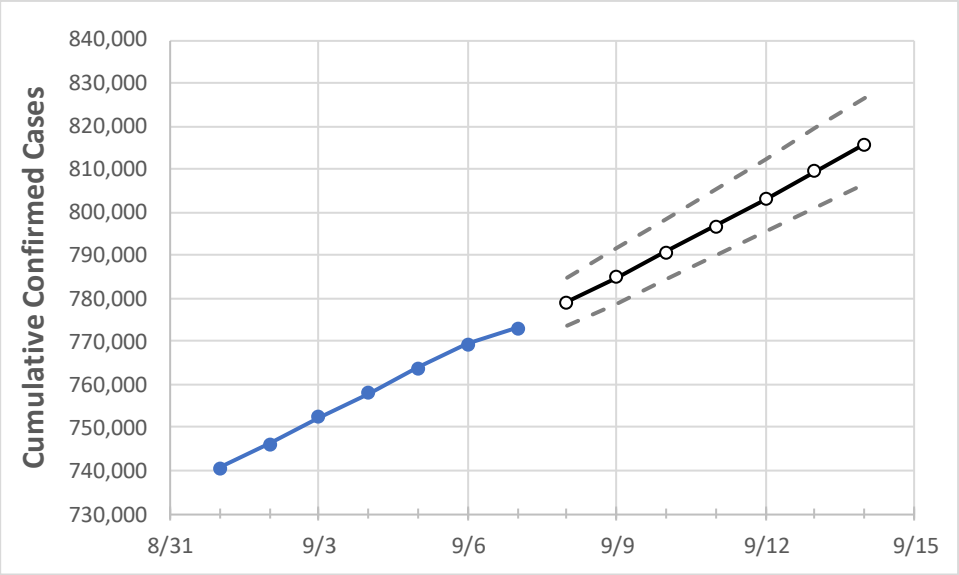
IEM's Modeling Lead

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:						
	9/4	9/5	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14
South Carolina	758,053	763,727	769,402	773,185	779,020	784,962	790,818	796,853	803,077	809,425	815,794

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:						
	9/4	9/5	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14
Beaufort	23,783	23,943	24,104	24,200	24,355	24,509	24,662	24,813	24,968	25,119	25,272
Charleston	57,173	57,564	57,954	58,112	58,497	58,896	59,284	59,678	60,066	60,474	60,872
Greenville	89,298	89,892	90,485	90,991	91,592	92,206	92,832	93,469	94,128	94,804	95,493
Kershaw	10,053	10,112	10,170	10,206	10,266	10,325	10,382	10,441	10,499	10,558	10,616
Lexington	46,040	46,436	46,832	47,098	47,510	47,916	48,325	48,747	49,164	49,597	50,031
Richland	59,511	59,834	60,157	60,327	60,649	60,977	61,292	61,616	61,949	62,277	62,611
Spartanburg	50,907	51,336	51,764	52,174	52,615	53,078	53,547	54,032	54,536	55,057	55,596
York	39,669	39,983	40,296	40,516	40,855	41,204	41,564	41,936	42,321	42,719	43,131

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:		
	9/4	9/5	9/6	9/7	9/9	9/11	9/13
Beaufort	23,783	23,943	24,104	24,200	24,509 (4,902) [1,176] {588}	24,813 (4,963) [1,191] {596}	25,119 (5,024) [1,206] {603}
Charleston	57,173	57,564	57,954	58,112	58,896 (11,779) [2,827] {1,414}	59,678 (11,936) [2,865] {1,432}	60,474 (12,095) [2,903] {1,451}
Greenville	89,298	89,892	90,485	90,991	92,206 (18,441) [4,426] {2,213}	93,469 (18,694) [4,487] {2,243}	94,804 (18,961) [4,551] {2,275}
Kershaw	10,053	10,112	10,170	10,206	10,325 (2,065) [496] {248}	10,441 (2,088) [501] {251}	10,558 (2,112) [507] {253}
Lexington	46,040	46,436	46,832	47,098	47,916 (9,583) [2,300] {1,150}	48,747 (9,749) [2,340] {1,170}	49,597 (9,919) [2,381] {1,190}
Richland	59,511	59,834	60,157	60,327	60,977 (12,195) [2,927] {1,463}	61,616 (12,323) [2,958] {1,479}	62,277 (12,455) [2,989] {1,495}
Spartanburg	50,907	51,336	51,764	52,174	53,078 (10,616) [2,548] {1,274}	54,032 (10,806) [2,594] {1,297}	55,057 (11,011) [2,643] {1,321}
York	39,669	39,983	40,296	40,516	41,204 (8,241) [1,978] {989}	41,936 (8,387) [2,013] {1,006}	42,719 (8,544) [2,051] {1,025}

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.