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

Date: 7/21/21

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 7/21/21 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.

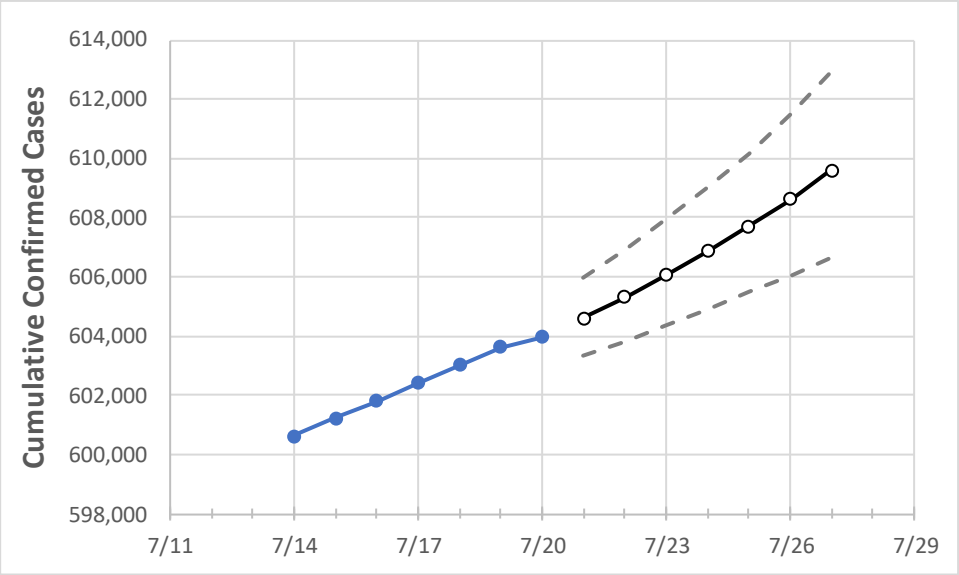
IEM's Modeling Lead

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:						
	7/17	7/18	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27
South Carolina	602,416	603,028	603,641	603,973	604,617	605,317	606,067	606,858	607,711	608,635	609,614

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:						
	7/17	7/18	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27
Beaufort	17,291	17,305	17,319	17,327	17,341	17,355	17,371	17,387	17,403	17,420	17,439
Charleston	44,415	44,469	44,523	44,532	44,589	44,650	44,714	44,784	44,859	44,940	45,025
Greenville	76,058	76,116	76,174	76,196	76,258	76,326	76,399	76,480	76,568	76,662	76,768
Kershaw	7,648	7,665	7,682	7,686	7,702	7,719	7,738	7,759	7,782	7,807	7,835
Lexington	34,223	34,272	34,322	34,341	34,394	34,451	34,512	34,577	34,646	34,721	34,802
Richland	48,252	48,318	48,383	48,416	48,470	48,525	48,584	48,644	48,708	48,772	48,841
Spartanburg	42,241	42,271	42,302	42,337	42,375	42,416	42,463	42,515	42,571	42,634	42,703
York	32,483	32,521	32,559	32,578	32,612	32,647	32,684	32,721	32,759	32,798	32,838

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:		
	7/17	7/18	7/19	7/20	7/22	7/24	7/26
Beaufort	17,291	17,305	17,319	17,327	17,355 (3,471) [833] {417}	17,387 (3,477) [835] {417}	17,420 (3,484) [836] {418}
Charleston	44,415	44,469	44,523	44,532	44,650 (8,930) [2,143] {1,072}	44,784 (8,957) [2,150] {1,075}	44,940 (8,988) [2,157] {1,079}
Greenville	76,058	76,116	76,174	76,196	76,326 (15,265) [3,664] {1,832}	76,480 (15,296) [3,671] {1,836}	76,662 (15,332) [3,680] {1,840}
Kershaw	7,648	7,665	7,682	7,686	7,719 (1,544) [371] {185}	7,759 (1,552) [372] {186}	7,807 (1,561) [375] {187}
Lexington	34,223	34,272	34,322	34,341	34,451 (6,890) [1,654] {827}	34,577 (6,915) [1,660] {830}	34,721 (6,944) [1,667] {833}
Richland	48,252	48,318	48,383	48,416	48,525 (9,705) [2,329] {1,165}	48,644 (9,729) [2,335] {1,167}	48,772 (9,754) [2,341] {1,171}
Spartanburg	42,241	42,271	42,302	42,337	42,416 (8,483) [2,036] {1,018}	42,515 (8,503) [2,041] {1,020}	42,634 (8,527) [2,046] {1,023}
York	32,483	32,521	32,559	32,578	32,647 (6,529) [1,567] {784}	32,721 (6,544) [1,571] {785}	32,798 (6,560) [1,574] {787}

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.