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

Date: 7/26/21

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 7/26/21 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.

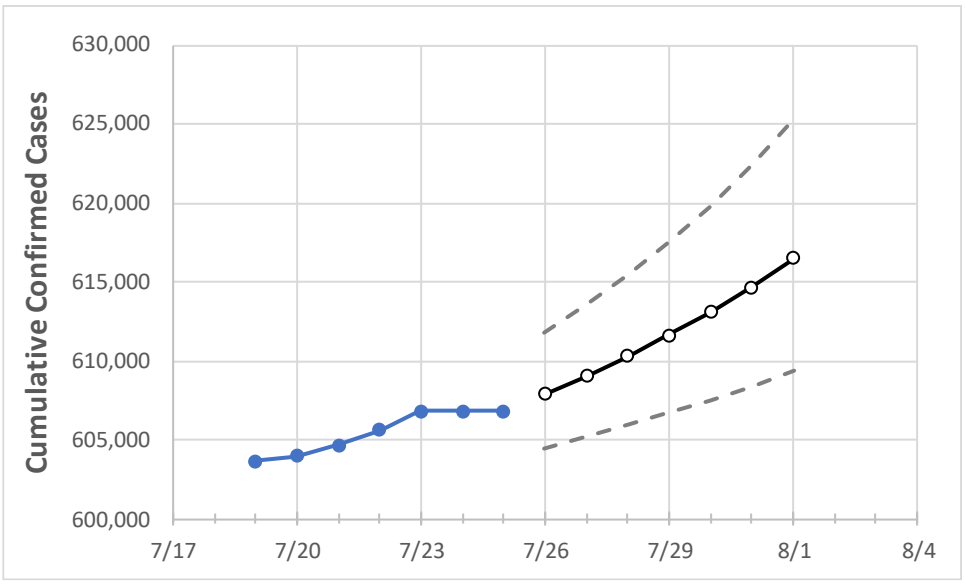
IEM's Modeling Lead

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:						
	7/22	7/23	7/24	7/25	7/26	7/27	7/28	7/29	7/30	7/31	8/1
South Carolina	605,590	606,833	606,833	606,833	607,900	609,054	610,300	611,649	613,070	614,665	616,473

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:						
	7/22	7/23	7/24	7/25	7/26	7/27	7/28	7/29	7/30	7/31	8/1
Beaufort	17,391	17,450	17,450	17,450	17,486	17,526	17,569	17,616	17,669	17,726	17,789
Charleston	44,659	44,737	44,737	44,737	44,819	44,905	44,999	45,100	45,207	45,325	45,454
Greenville	76,323	76,419	76,419	76,419	76,505	76,600	76,700	76,806	76,928	77,061	77,203
Kershaw	7,726	7,749	7,749	7,749	7,776	7,806	7,838	7,876	7,916	7,960	8,009
Lexington	34,465	34,598	34,598	34,598	34,705	34,820	34,948	35,087	35,242	35,412	35,603
Richland	48,557	48,683	48,683	48,683	48,772	48,870	48,973	49,081	49,194	49,315	49,445
Spartanburg	42,433	42,478	42,478	42,478	42,534	42,596	42,663	42,737	42,819	42,908	43,004
York	32,658	32,721	32,721	32,721	32,770	32,821	32,875	32,933	32,994	33,057	33,123

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:		
	7/22	7/23	7/24	7/25	7/27	7/29	7/31
Beaufort	17,391	17,450	17,450	17,450	17,526 (3,505) [841] {421}	17,616 (3,523) [846] {423}	17,726 (3,545) [851] {425}
Charleston	44,659	44,737	44,737	44,737	44,905 (8,981) [2,155] {1,078}	45,100 (9,020) [2,165] {1,082}	45,325 (9,065) [2,176] {1,088}
Greenville	76,323	76,419	76,419	76,419	76,600 (15,320) [3,677] {1,838}	76,806 (15,361) [3,687] {1,843}	77,061 (15,412) [3,699] {1,849}
Kershaw	7,726	7,749	7,749	7,749	7,806 (1,561) [375] {187}	7,876 (1,575) [378] {189}	7,960 (1,592) [382] {191}
Lexington	34,465	34,598	34,598	34,598	34,820 (6,964) [1,671] {836}	35,087 (7,017) [1,684] {842}	35,412 (7,082) [1,700] {850}
Richland	48,557	48,683	48,683	48,683	48,870 (9,774) [2,346] {1,173}	49,081 (9,816) [2,356] {1,178}	49,315 (9,863) [2,367] {1,184}
Spartanburg	42,433	42,478	42,478	42,478	42,596 (8,519) [2,045] {1,022}	42,737 (8,547) [2,051] {1,026}	42,908 (8,582) [2,060] {1,030}
York	32,658	32,721	32,721	32,721	32,821 (6,564) [1,575] {788}	32,933 (6,587) [1,581] {790}	33,057 (6,611) [1,587] {793}

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.