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

Date: 2/23/21

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 2/23/21 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.

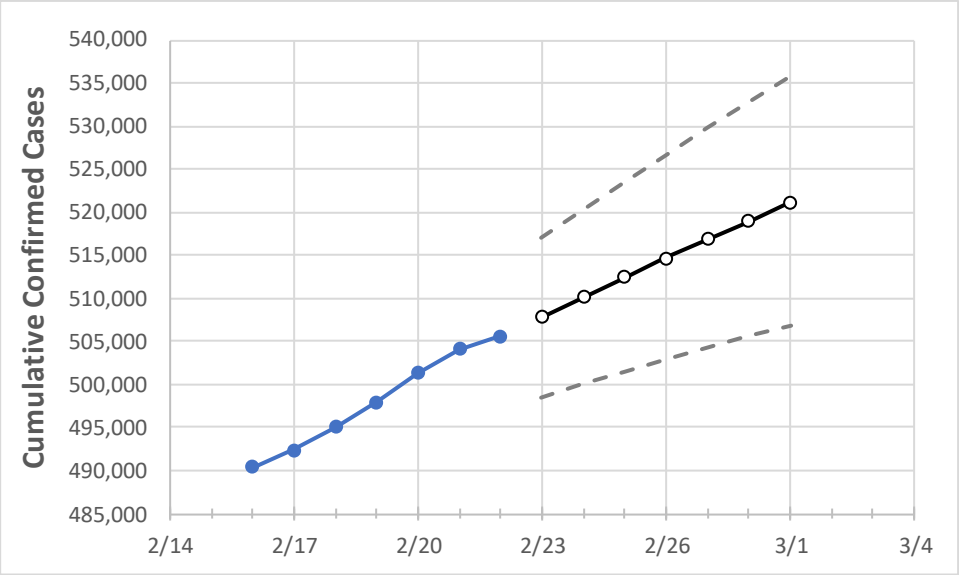
IEM's Modeling Lead

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
South Carolina	497,937	501,277	504,149	505,589	507,879	510,129	512,412	514,666	516,832	518,995	521,126

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Beaufort	14,902	15,004	15,078	15,112	15,160	15,208	15,255	15,301	15,345	15,386	15,428
Charleston	36,983	37,161	37,332	37,414	37,571	37,723	37,877	38,023	38,168	38,305	38,439
Greenville	62,014	62,248	62,535	62,644	62,856	63,059	63,253	63,443	63,624	63,798	63,971
Kershaw	6,394	6,443	6,505	6,536	6,579	6,622	6,663	6,705	6,746	6,789	6,830
Lexington	28,412	28,730	29,020	29,138	29,366	29,590	29,821	30,043	30,275	30,516	30,746
Richland	39,694	40,046	40,371	40,504	40,715	40,927	41,130	41,345	41,550	41,759	41,964
Spartanburg	34,437	34,678	34,925	35,028	35,185	35,341	35,497	35,643	35,789	35,937	36,074
York	25,119	25,375	25,572	25,686	25,834	25,981	26,131	26,278	26,426	26,570	26,715

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:		
	2/19	2/20	2/21	2/22	2/24	2/26	2/28
Beaufort	14,902	15,004	15,078	15,112	15,208 (3,042) [730] {365}	15,301 (3,060) [734] {367}	15,386 (3,077) [739] {369}
Charleston	36,983	37,161	37,332	37,414	37,723 (7,545) [1,811] {905}	38,023 (7,605) [1,825] {913}	38,305 (7,661) [1,839] {919}
Greenville	62,014	62,248	62,535	62,644	63,059 (12,612) [3,027] {1,513}	63,443 (12,689) [3,045] {1,523}	63,798 (12,760) [3,062] {1,531}
Kershaw	6,394	6,443	6,505	6,536	6,622 (1,324) [318] {159}	6,705 (1,341) [322] {161}	6,789 (1,358) [326] {163}
Lexington	28,412	28,730	29,020	29,138	29,590 (5,918) [1,420] {710}	30,043 (6,009) [1,442] {721}	30,516 (6,103) [1,465] {732}
Richland	39,694	40,046	40,371	40,504	40,927 (8,185) [1,964] {982}	41,345 (8,269) [1,985] {992}	41,759 (8,352) [2,004] {1,002}
Spartanburg	34,437	34,678	34,925	35,028	35,341 (7,068) [1,696] {848}	35,643 (7,129) [1,711] {855}	35,937 (7,187) [1,725] {862}
York	25,119	25,375	25,572	25,686	25,981 (5,196) [1,247] {624}	26,278 (5,256) [1,261] {631}	26,570 (5,314) [1,275] {638}

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.