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

Date: 3/3/21

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 3/3/21 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.

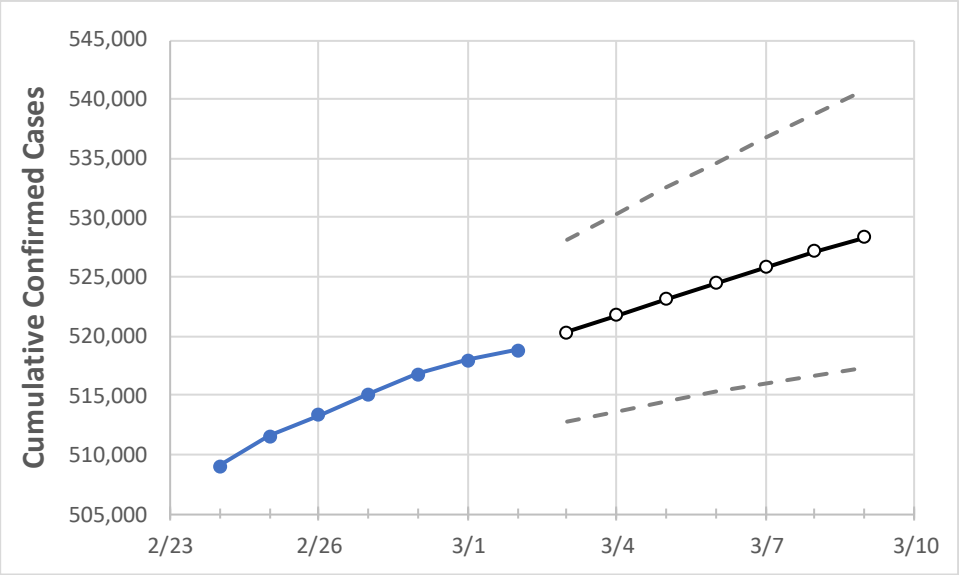
IEM's Modeling Lead

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:						
	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9
South Carolina	515,072	516,823	517,976	518,823	520,344	521,783	523,137	524,502	525,854	527,167	528,385

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:						
	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9
Beaufort	15,378	15,436	15,470	15,500	15,543	15,587	15,628	15,667	15,707	15,745	15,782
Charleston	37,980	38,134	38,212	38,289	38,381	38,468	38,549	38,626	38,699	38,770	38,839
Greenville	63,643	63,837	63,961	64,064	64,206	64,340	64,473	64,604	64,727	64,846	64,956
Kershaw	6,683	6,698	6,709	6,717	6,740	6,763	6,784	6,805	6,826	6,845	6,864
Lexington	29,720	29,819	29,878	29,924	30,042	30,158	30,264	30,366	30,465	30,565	30,660
Richland	41,212	41,361	41,444	41,499	41,641	41,783	41,918	42,048	42,180	42,308	42,433
Spartanburg	35,723	35,812	35,907	35,962	36,063	36,161	36,254	36,347	36,435	36,516	36,595
York	26,524	26,643	26,696	26,745	26,881	27,013	27,146	27,275	27,405	27,533	27,655

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:		
	2/27	2/28	3/1	3/2	3/4	3/6	3/8
Beaufort	15,378	15,436	15,470	15,500	15,587 (3,117) [748] {374}	15,667 (3,133) [752] {376}	15,745 (3,149) [756] {378}
Charleston	37,980	38,134	38,212	38,289	38,468 (7,694) [1,846] {923}	38,626 (7,725) [1,854] {927}	38,770 (7,754) [1,861] {930}
Greenville	63,643	63,837	63,961	64,064	64,340 (12,868) [3,088] {1,544}	64,604 (12,921) [3,101] {1,550}	64,846 (12,969) [3,113] {1,556}
Kershaw	6,683	6,698	6,709	6,717	6,763 (1,353) [325] {162}	6,805 (1,361) [327] {163}	6,845 (1,369) [329] {164}
Lexington	29,720	29,819	29,878	29,924	30,158 (6,032) [1,448] {724}	30,366 (6,073) [1,458] {729}	30,565 (6,113) [1,467] {734}
Richland	41,212	41,361	41,444	41,499	41,783 (8,357) [2,006] {1,003}	42,048 (8,410) [2,018] {1,009}	42,308 (8,462) [2,031] {1,015}
Spartanburg	35,723	35,812	35,907	35,962	36,161 (7,232) [1,736] {868}	36,347 (7,269) [1,745] {872}	36,516 (7,303) [1,753] {876}
York	26,524	26,643	26,696	26,745	27,013 (5,403) [1,297] {648}	27,275 (5,455) [1,309] {655}	27,533 (5,507) [1,322] {661}

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.