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

Date: 2/17/21

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 2/17/21 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.

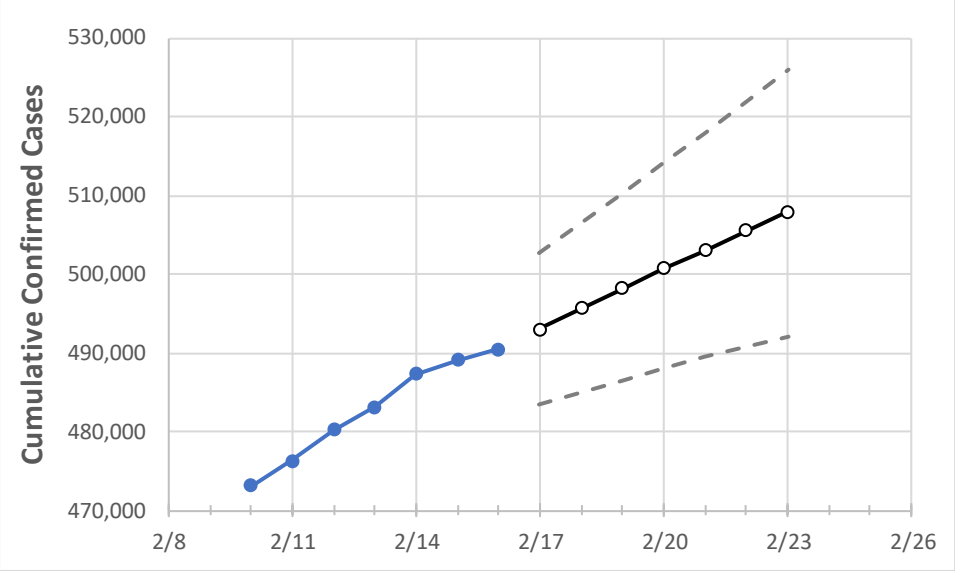
IEM's Modeling Lead

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:						
	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23
South Carolina	483,140	487,293	489,018	490,453	493,024	495,654	498,215	500,686	503,061	505,539	507,889

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:						
	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23
Beaufort	14,587	14,659	14,690	14,736	14,792	14,844	14,895	14,943	14,990	15,034	15,080
Charleston	35,877	36,256	36,381	36,497	36,701	36,902	37,101	37,295	37,486	37,677	37,868
Greenville	60,548	60,996	61,130	61,269	61,553	61,824	62,086	62,338	62,580	62,820	63,068
Kershaw	6,156	6,210	6,251	6,270	6,309	6,346	6,383	6,420	6,456	6,490	6,525
Lexington	27,209	27,463	27,631	27,731	27,930	28,129	28,326	28,524	28,729	28,940	29,140
Richland	38,490	38,802	38,966	39,097	39,291	39,485	39,675	39,860	40,054	40,246	40,427
Spartanburg	33,442	33,740	33,841	33,932	34,140	34,339	34,530	34,722	34,916	35,100	35,286
York	24,232	24,484	24,594	24,668	24,814	24,960	25,104	25,245	25,383	25,524	25,662

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:		
	2/13	2/14	2/15	2/16	2/18	2/20	2/22
Beaufort	14,587	14,659	14,690	14,736	14,844 (2,969) [713] {356}	14,943 (2,989) [717] {359}	15,034 (3,007) [722] {361}
Charleston	35,877	36,256	36,381	36,497	36,902 (7,380) [1,771] {886}	37,295 (7,459) [1,790] {895}	37,677 (7,535) [1,808] {904}
Greenville	60,548	60,996	61,130	61,269	61,824 (12,365) [2,968] {1,484}	62,338 (12,468) [2,992] {1,496}	62,820 (12,564) [3,015] {1,508}
Kershaw	6,156	6,210	6,251	6,270	6,346 (1,269) [305] {152}	6,420 (1,284) [308] {154}	6,490 (1,298) [312] {156}
Lexington	27,209	27,463	27,631	27,731	28,129 (5,626) [1,350] {675}	28,524 (5,705) [1,369] {685}	28,940 (5,788) [1,389] {695}
Richland	38,490	38,802	38,966	39,097	39,485 (7,897) [1,895] {948}	39,860 (7,972) [1,913] {957}	40,246 (8,049) [1,932] {966}
Spartanburg	33,442	33,740	33,841	33,932	34,339 (6,868) [1,648] {824}	34,722 (6,944) [1,667] {833}	35,100 (7,020) [1,685] {842}
York	24,232	24,484	24,594	24,668	24,960 (4,992) [1,198] {599}	25,245 (5,049) [1,212] {606}	25,524 (5,105) [1,225] {613}

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.