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

Date: 4/16/21

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 4/16/21 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.

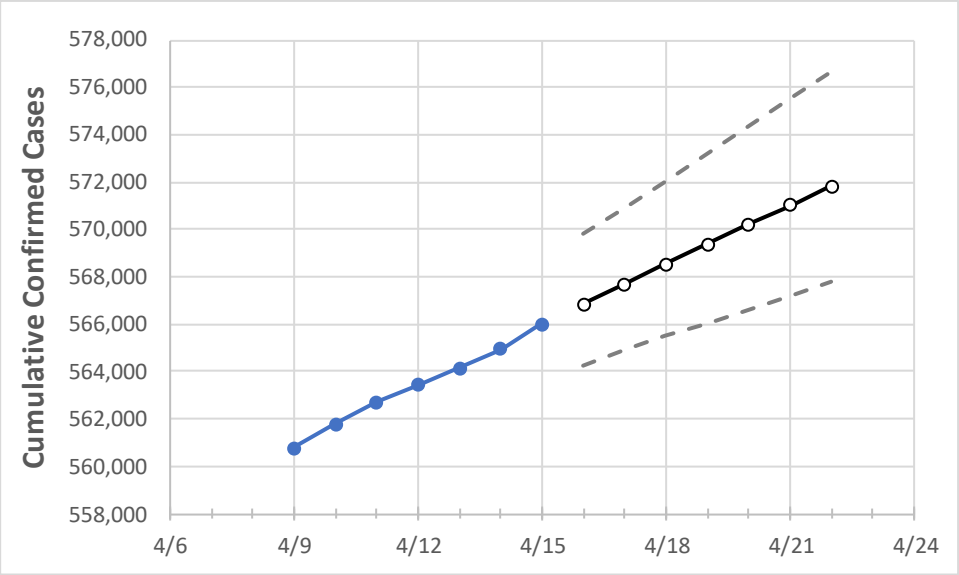
IEM's Modeling Lead

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:						
	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	4/21	4/22
South Carolina	563,427	564,128	564,931	566,018	566,859	567,700	568,543	569,387	570,213	571,024	571,828

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:						
	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	4/21	4/22
Beaufort	16,462	16,467	16,477	16,486	16,499	16,511	16,524	16,536	16,547	16,559	16,571
Charleston	41,540	41,587	41,647	41,741	41,810	41,880	41,948	42,019	42,089	42,156	42,223
Greenville	71,562	71,657	71,790	71,921	72,065	72,205	72,344	72,483	72,618	72,751	72,879
Kershaw	7,174	7,177	7,183	7,200	7,209	7,218	7,226	7,235	7,243	7,252	7,261
Lexington	32,192	32,237	32,283	32,351	32,399	32,447	32,497	32,544	32,593	32,642	32,691
Richland	44,715	44,764	44,843	44,935	45,003	45,070	45,139	45,207	45,274	45,342	45,408
Spartanburg	39,870	39,950	39,979	40,043	40,107	40,170	40,231	40,294	40,355	40,410	40,465
York	29,361	29,422	29,501	29,570	29,633	29,696	29,758	29,821	29,883	29,946	30,010

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:		
	4/12	4/13	4/14	4/15	4/17	4/19	4/21
Beaufort	16,462	16,467	16,477	16,486	16,511 (3,302) [793] {396}	16,536 (3,307) [794] {397}	16,559 (3,312) [795] {397}
Charleston	41,540	41,587	41,647	41,741	41,880 (8,376) [2,010] {1,005}	42,019 (8,404) [2,017] {1,008}	42,156 (8,431) [2,024] {1,012}
Greenville	71,562	71,657	71,790	71,921	72,205 (14,441) [3,466] {1,733}	72,483 (14,497) [3,479] {1,740}	72,751 (14,550) [3,492] {1,746}
Kershaw	7,174	7,177	7,183	7,200	7,218 (1,444) [346] {173}	7,235 (1,447) [347] {174}	7,252 (1,450) [348] {174}
Lexington	32,192	32,237	32,283	32,351	32,447 (6,489) [1,557] {779}	32,544 (6,509) [1,562] {781}	32,642 (6,528) [1,567] {783}
Richland	44,715	44,764	44,843	44,935	45,070 (9,014) [2,163] {1,082}	45,207 (9,041) [2,170] {1,085}	45,342 (9,068) [2,176] {1,088}
Spartanburg	39,870	39,950	39,979	40,043	40,170 (8,034) [1,928] {964}	40,294 (8,059) [1,934] {967}	40,410 (8,082) [1,940] {970}
York	29,361	29,422	29,501	29,570	29,696 (5,939) [1,425] {713}	29,821 (5,964) [1,431] {716}	29,946 (5,989) [1,437] {719}

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.