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

Date: 4/13/21

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 4/13/21 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.

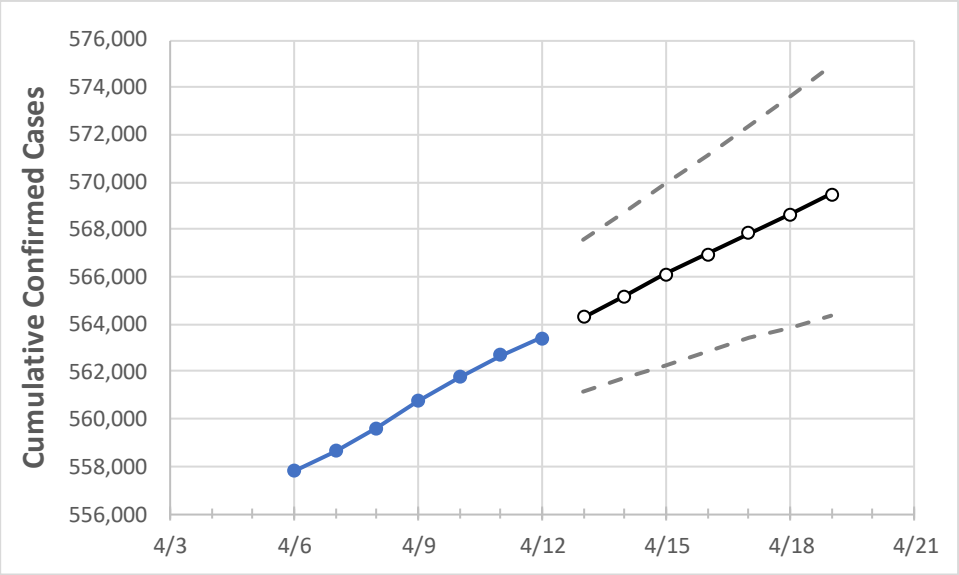
IEM's Modeling Lead

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:						
	4/9	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19
South Carolina	560,762	561,773	562,691	563,427	564,319	565,204	566,103	566,960	567,829	568,630	569,470

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:						
	4/9	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19
Beaufort	16,404	16,423	16,446	16,462	16,477	16,491	16,505	16,518	16,532	16,545	16,558
Charleston	41,310	41,390	41,471	41,540	41,613	41,684	41,755	41,825	41,896	41,966	42,039
Greenville	71,161	71,341	71,456	71,562	71,720	71,875	72,030	72,185	72,340	72,489	72,644
Kershaw	7,144	7,152	7,161	7,174	7,183	7,193	7,202	7,211	7,220	7,230	7,239
Lexington	32,036	32,083	32,135	32,192	32,238	32,284	32,329	32,373	32,417	32,459	32,502
Richland	44,510	44,599	44,664	44,715	44,781	44,849	44,914	44,977	45,040	45,103	45,168
Spartanburg	39,714	39,770	39,826	39,870	39,948	40,025	40,101	40,176	40,251	40,323	40,396
York	29,213	29,258	29,318	29,361	29,421	29,482	29,542	29,605	29,665	29,727	29,787

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:		
	4/9	4/10	4/11	4/12	4/14	4/16	4/18
Beaufort	16,404	16,423	16,446	16,462	16,491 (3,298) [792] {396}	16,518 (3,304) [793] {396}	16,545 (3,309) [794] {397}
Charleston	41,310	41,390	41,471	41,540	41,684 (8,337) [2,001] {1,000}	41,825 (8,365) [2,008] {1,004}	41,966 (8,393) [2,014] {1,007}
Greenville	71,161	71,341	71,456	71,562	71,875 (14,375) [3,450] {1,725}	72,185 (14,437) [3,465] {1,732}	72,489 (14,498) [3,479] {1,740}
Kershaw	7,144	7,152	7,161	7,174	7,193 (1,439) [345] {173}	7,211 (1,442) [346] {173}	7,230 (1,446) [347] {174}
Lexington	32,036	32,083	32,135	32,192	32,284 (6,457) [1,550] {775}	32,373 (6,475) [1,554] {777}	32,459 (6,492) [1,558] {779}
Richland	44,510	44,599	44,664	44,715	44,849 (8,970) [2,153] {1,076}	44,977 (8,995) [2,159] {1,079}	45,103 (9,021) [2,165] {1,082}
Spartanburg	39,714	39,770	39,826	39,870	40,025 (8,005) [1,921] {961}	40,176 (8,035) [1,928] {964}	40,323 (8,065) [1,935] {968}
York	29,213	29,258	29,318	29,361	29,482 (5,896) [1,415] {708}	29,605 (5,921) [1,421] {711}	29,727 (5,945) [1,427] {713}

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.