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

Date: 1/27/21

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 1/27/21 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.

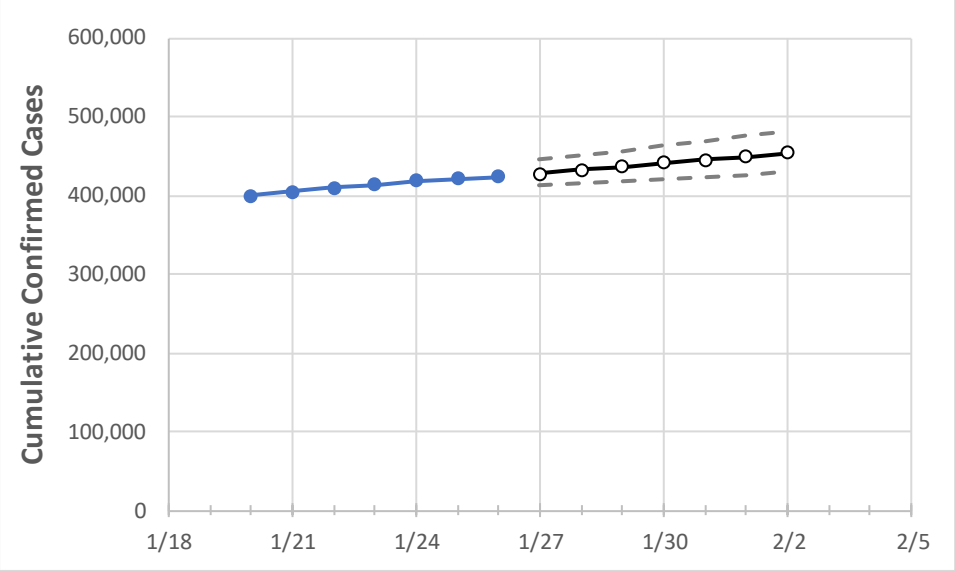
IEM's Modeling Lead

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:						
	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2
South Carolina	413,789	418,325	421,417	423,667	428,052	432,414	436,725	440,994	445,289	449,638	453,917

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:						
	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2
Beaufort	12,600	12,715	12,807	12,864	12,988	13,112	13,234	13,358	13,482	13,609	13,740
Charleston	30,633	30,997	31,170	31,288	31,577	31,874	32,173	32,477	32,775	33,072	33,368
Greenville	52,283	52,806	53,236	53,531	54,057	54,557	55,067	55,572	56,077	56,564	57,052
Kershaw	5,153	5,218	5,265	5,284	5,344	5,403	5,462	5,522	5,584	5,643	5,706
Lexington	23,082	23,296	23,455	23,594	23,834	24,076	24,304	24,537	24,765	24,991	25,226
Richland	33,532	33,965	34,167	34,331	34,647	34,983	35,318	35,661	36,006	36,347	36,694
Spartanburg	27,778	28,092	28,286	28,505	28,873	29,242	29,611	29,992	30,359	30,753	31,140
York	20,774	20,973	21,152	21,285	21,510	21,729	21,945	22,161	22,377	22,596	22,812

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:		
	1/23	1/24	1/25	1/26	1/28	1/30	2/1
Beaufort	12,600	12,715	12,807	12,864	13,112 (2,622) [629] {315}	13,358 (2,672) [641] {321}	13,609 (2,722) [653] {327}
Charleston	30,633	30,997	31,170	31,288	31,874 (6,375) [1,530] {765}	32,477 (6,495) [1,559] {779}	33,072 (6,614) [1,587] {794}
Greenville	52,283	52,806	53,236	53,531	54,557 (10,911) [2,619] {1,309}	55,572 (11,114) [2,667] {1,334}	56,564 (11,313) [2,715] {1,358}
Kershaw	5,153	5,218	5,265	5,284	5,403 (1,081) [259] {130}	5,522 (1,104) [265] {133}	5,643 (1,129) [271] {135}
Lexington	23,082	23,296	23,455	23,594	24,076 (4,815) [1,156] {578}	24,537 (4,907) [1,178] {589}	24,991 (4,998) [1,200] {600}
Richland	33,532	33,965	34,167	34,331	34,983 (6,997) [1,679] {840}	35,661 (7,132) [1,712] {856}	36,347 (7,269) [1,745] {872}
Spartanburg	27,778	28,092	28,286	28,505	29,242 (5,848) [1,404] {702}	29,992 (5,998) [1,440] {720}	30,753 (6,151) [1,476] {738}
York	20,774	20,973	21,152	21,285	21,729 (4,346) [1,043] {521}	22,161 (4,432) [1,064] {532}	22,596 (4,519) [1,085] {542}

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.