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

Date: 1/15/21

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 1/15/21 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.

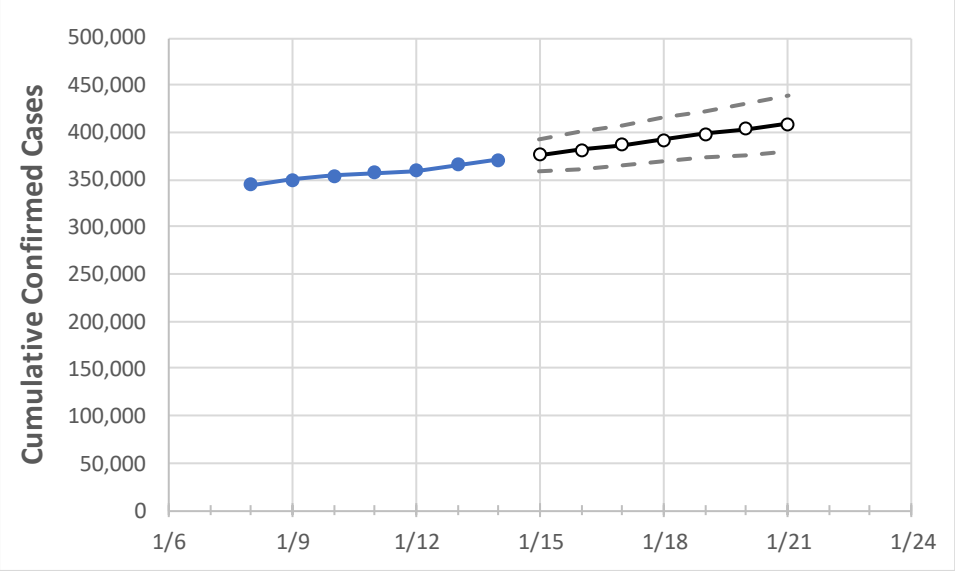
IEM's Modeling Lead

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:						
	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19	1/20	1/21
South Carolina	357,654	359,357	365,378	371,180	376,349	381,594	386,956	392,540	398,027	403,725	409,390

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:						
	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19	1/20	1/21
Beaufort	10,958	11,005	11,157	11,339	11,476	11,614	11,758	11,899	12,049	12,204	12,361
Charleston	27,180	27,255	27,591	27,962	28,306	28,660	29,031	29,411	29,809	30,227	30,645
Greenville	45,085	45,252	46,101	46,933	47,665	48,428	49,183	49,930	50,708	51,494	52,296
Kershaw	4,425	4,453	4,553	4,631	4,695	4,762	4,829	4,903	4,975	5,050	5,129
Lexington	19,795	19,870	20,268	20,625	20,935	21,256	21,576	21,902	22,239	22,588	22,945
Richland	29,571	29,637	29,965	30,447	30,793	31,146	31,508	31,875	32,258	32,643	33,050
Spartanburg	23,360	23,445	23,787	24,263	24,611	24,975	25,333	25,691	26,081	26,470	26,864
York	17,911	17,974	18,329	18,576	18,827	19,082	19,347	19,612	19,878	20,149	20,414

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:		
	1/11	1/12	1/13	1/14	1/16	1/18	1/20
Beaufort	10,958	11,005	11,157	11,339	11,614 (2,323) [557] {279}	11,899 (2,380) [571] {286}	12,204 (2,441) [586] {293}
Charleston	27,180	27,255	27,591	27,962	28,660 (5,732) [1,376] {688}	29,411 (5,882) [1,412] {706}	30,227 (6,045) [1,451] {725}
Greenville	45,085	45,252	46,101	46,933	48,428 (9,686) [2,325] {1,162}	49,930 (9,986) [2,397] {1,198}	51,494 (10,299) [2,472] {1,236}
Kershaw	4,425	4,453	4,553	4,631	4,762 (952) [229] {114}	4,903 (981) [235] {118}	5,050 (1,010) [242] {121}
Lexington	19,795	19,870	20,268	20,625	21,256 (4,251) [1,020] {510}	21,902 (4,380) [1,051] {526}	22,588 (4,518) [1,084] {542}
Richland	29,571	29,637	29,965	30,447	31,146 (6,229) [1,495] {747}	31,875 (6,375) [1,530] {765}	32,643 (6,529) [1,567] {783}
Spartanburg	23,360	23,445	23,787	24,263	24,975 (4,995) [1,199] {599}	25,691 (5,138) [1,233] {617}	26,470 (5,294) [1,271] {635}
York	17,911	17,974	18,329	18,576	19,082 (3,816) [916] {458}	19,612 (3,922) [941] {471}	20,149 (4,030) [967] {484}

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.