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

Date: 1/31/22

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 1/31/22 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.

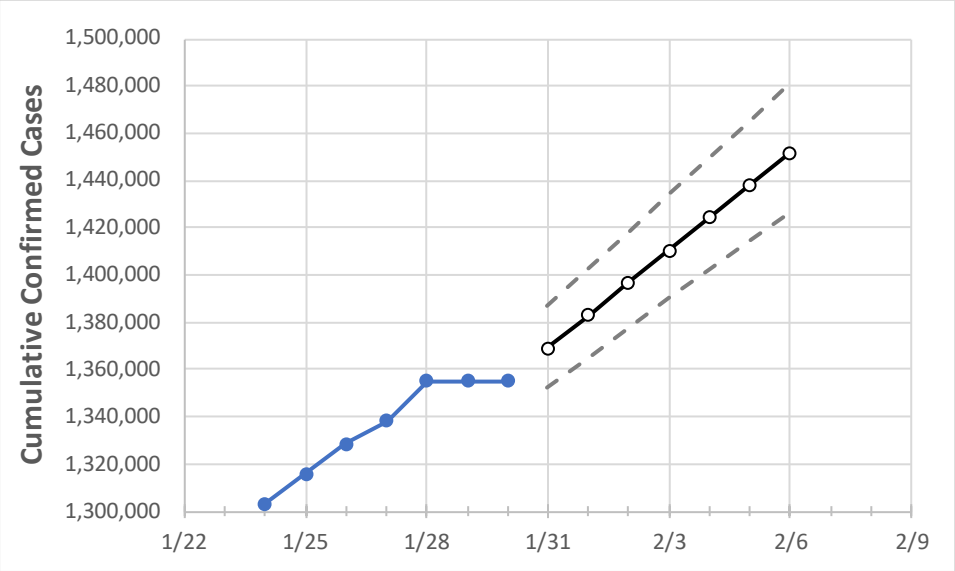
IEM's Modeling Lead

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:						
	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6
South Carolina	1,338,384	1,355,116	1,355,116	1,355,116	1,369,083	1,382,928	1,396,799	1,410,483	1,424,430	1,438,110	1,451,673

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:						
	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6
Beaufort	38,708	39,258	39,258	39,258	39,637	40,018	40,387	40,758	41,142	41,520	41,877
Charleston	102,217	103,499	103,499	103,499	104,485	105,496	106,456	107,433	108,415	109,381	110,327
Greenville	158,094	159,827	159,827	159,827	161,454	163,108	164,717	166,316	167,883	169,520	171,132
Kershaw	19,012	19,293	19,293	19,293	19,524	19,758	19,982	20,213	20,445	20,670	20,891
Lexington	86,560	87,809	87,809	87,809	88,932	90,059	91,151	92,258	93,382	94,498	95,605
Richland	110,423	111,938	111,938	111,938	112,938	113,937	114,891	115,869	116,797	117,727	118,631
Spartanburg	87,762	88,610	88,610	88,610	89,477	90,357	91,214	92,074	92,939	93,794	94,664
York	70,055	70,938	70,938	70,938	71,686	72,425	73,164	73,912	74,653	75,399	76,132

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:		
	1/27	1/28	1/29	1/30	2/1	2/3	2/5
Beaufort	38,708	39,258	39,258	39,258	40,018 (8,004) [1,921] {960}	40,758 (8,152) [1,956] {978}	41,520 (8,304) [1,993] {996}
Charleston	102,217	103,499	103,499	103,499	105,496 (21,099) [5,064] {2,532}	107,433 (21,487) [5,157] {2,578}	109,381 (21,876) [5,250] {2,625}
Greenville	158,094	159,827	159,827	159,827	163,108 (32,622) [7,829] {3,915}	166,316 (33,263) [7,983] {3,992}	169,520 (33,904) [8,137] {4,068}
Kershaw	19,012	19,293	19,293	19,293	19,758 (3,952) [948] {474}	20,213 (4,043) [970] {485}	20,670 (4,134) [992] {496}
Lexington	86,560	87,809	87,809	87,809	90,059 (18,012) [4,323] {2,161}	92,258 (18,452) [4,428] {2,214}	94,498 (18,900) [4,536] {2,268}
Richland	110,423	111,938	111,938	111,938	113,937 (22,787) [5,469] {2,734}	115,869 (23,174) [5,562] {2,781}	117,727 (23,545) [5,651] {2,825}
Spartanburg	87,762	88,610	88,610	88,610	90,357 (18,071) [4,337] {2,169}	92,074 (18,415) [4,420] {2,210}	93,794 (18,759) [4,502] {2,251}
York	70,055	70,938	70,938	70,938	72,425 (14,485) [3,476] {1,738}	73,912 (14,782) [3,548] {1,774}	75,399 (15,080) [3,619] {1,810}

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.