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

Date: 12/16/20

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 12/16/20 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.

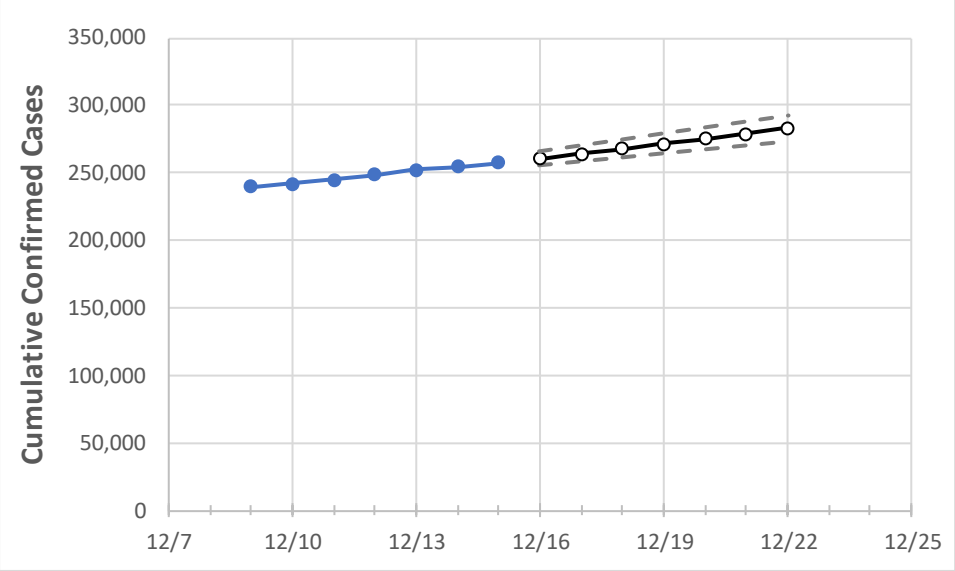
IEM's Modeling Lead

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:						
	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22
South Carolina	248,798	252,206	254,776	257,320	260,665	264,114	267,669	271,333	275,108	278,999	283,007

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 20%, and are often within 10%, of actual confirmed cases.

South Carolina Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22
Beaufort	7,954	8,059	8,109	8,179	8,267	8,357	8,451	8,549	8,650	8,755	8,863
Charleston	21,541	21,696	21,783	21,889	22,026	22,165	22,305	22,448	22,592	22,738	22,886
Greenville	28,453	28,956	29,370	29,816	30,323	30,848	31,392	31,955	32,539	33,144	33,770
Kershaw	3,276	3,297	3,324	3,353	3,384	3,416	3,450	3,484	3,520	3,556	3,594
Lexington	13,044	13,239	13,411	13,562	13,750	13,946	14,150	14,362	14,583	14,812	15,051
Richland	22,650	22,874	23,031	23,165	23,389	23,619	23,856	24,100	24,351	24,609	24,875
Spartanburg	15,168	15,515	15,759	15,972	16,275	16,590	16,917	17,257	17,610	17,976	18,357
York	11,932	12,097	12,228	12,452	12,663	12,879	13,101	13,329	13,563	13,803	14,049

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:		
	12/12	12/13	12/14	12/15	12/17	12/19	12/21
Beaufort	7,954	8,059	8,109	8,179	8,357 (1,671) [401] {201}	8,549 (1,710) [410] {205}	8,755 (1,751) [420] {210}
Charleston	21,541	21,696	21,783	21,889	22,165 (4,433) [1,064] {532}	22,448 (4,490) [1,077] {539}	22,738 (4,548) [1,091] {546}
Greenville	28,453	28,956	29,370	29,816	30,848 (6,170) [1,481] {740}	31,955 (6,391) [1,534] {767}	33,144 (6,629) [1,591] {795}
Kershaw	3,276	3,297	3,324	3,353	3,416 (683) [164] {82}	3,484 (697) [167] {84}	3,556 (711) [171] {85}
Lexington	13,044	13,239	13,411	13,562	13,946 (2,789) [669] {335}	14,362 (2,872) [689] {345}	14,812 (2,962) [711] {355}
Richland	22,650	22,874	23,031	23,165	23,619 (4,724) [1,134] {567}	24,100 (4,820) [1,157] {578}	24,609 (4,922) [1,181] {591}
Spartanburg	15,168	15,515	15,759	15,972	16,590 (3,318) [796] {398}	17,257 (3,451) [828] {414}	17,976 (3,595) [863] {431}
York	11,932	12,097	12,228	12,452	12,879 (2,576) [618] {309}	13,329 (2,666) [640] {320}	13,803 (2,761) [663] {331}

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.