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

Date: 1/26/21

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 1/26/21 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.

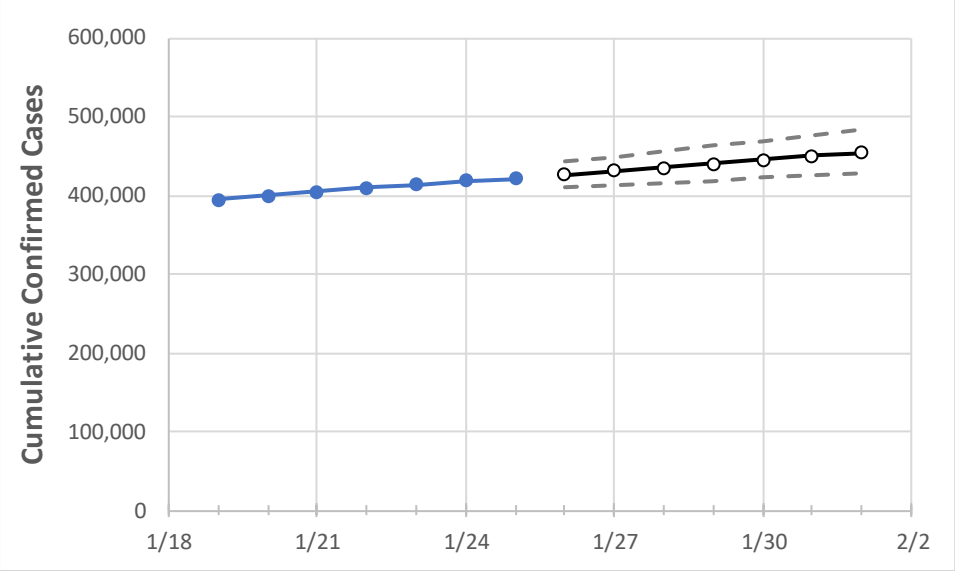
IEM's Modeling Lead

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:						
	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1
South Carolina	409,188	413,789	418,325	421,417	426,040	430,769	435,486	440,251	445,049	449,875	454,695

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:						
	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1
Beaufort	12,479	12,600	12,715	12,807	12,938	13,072	13,206	13,345	13,484	13,629	13,770
Charleston	30,328	30,633	30,997	31,170	31,484	31,804	32,125	32,449	32,781	33,118	33,463
Greenville	51,794	52,283	52,806	53,236	53,783	54,313	54,858	55,386	55,917	56,448	56,971
Kershaw	5,085	5,153	5,218	5,265	5,329	5,392	5,456	5,521	5,587	5,655	5,720
Lexington	22,809	23,082	23,296	23,455	23,702	23,955	24,203	24,442	24,690	24,933	25,171
Richland	33,030	33,532	33,965	34,167	34,525	34,880	35,246	35,607	35,974	36,349	36,738
Spartanburg	27,475	27,778	28,092	28,286	28,664	29,043	29,444	29,856	30,257	30,656	31,078
York	20,560	20,774	20,973	21,152	21,378	21,607	21,830	22,049	22,271	22,490	22,719

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:		
	1/22	1/23	1/24	1/25	1/27	1/29	1/31
Beaufort	12,479	12,600	12,715	12,807	13,072 (2,614) [627] {314}	13,345 (2,669) [641] {320}	13,629 (2,726) [654] {327}
Charleston	30,328	30,633	30,997	31,170	31,804 (6,361) [1,527] {763}	32,449 (6,490) [1,558] {779}	33,118 (6,624) [1,590] {795}
Greenville	51,794	52,283	52,806	53,236	54,313 (10,863) [2,607] {1,304}	55,386 (11,077) [2,659] {1,329}	56,448 (11,290) [2,709] {1,355}
Kershaw	5,085	5,153	5,218	5,265	5,392 (1,078) [259] {129}	5,521 (1,104) [265] {133}	5,655 (1,131) [271] {136}
Lexington	22,809	23,082	23,296	23,455	23,955 (4,791) [1,150] {575}	24,442 (4,888) [1,173] {587}	24,933 (4,987) [1,197] {598}
Richland	33,030	33,532	33,965	34,167	34,880 (6,976) [1,674] {837}	35,607 (7,121) [1,709] {855}	36,349 (7,270) [1,745] {872}
Spartanburg	27,475	27,778	28,092	28,286	29,043 (5,809) [1,394] {697}	29,856 (5,971) [1,433] {717}	30,656 (6,131) [1,471] {736}
York	20,560	20,774	20,973	21,152	21,607 (4,321) [1,037] {519}	22,049 (4,410) [1,058] {529}	22,490 (4,498) [1,080] {540}

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.