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

Date: 2/9/21

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 2/9/21 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.

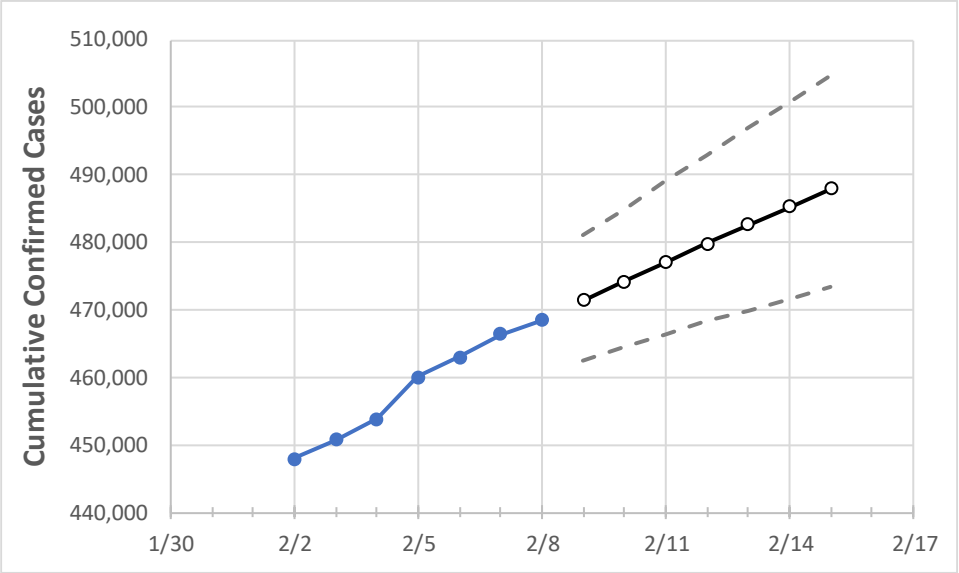
IEM's Modeling Lead

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:						
	2/5	2/6	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15
South Carolina	459,974	462,981	466,373	468,403	471,342	474,268	477,091	479,858	482,604	485,298	487,983

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:						
	2/5	2/6	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15
Beaufort	14,062	14,135	14,215	14,264	14,362	14,458	14,555	14,651	14,745	14,839	14,931
Charleston	34,062	34,332	34,589	34,748	34,996	35,232	35,472	35,712	35,949	36,190	36,429
Greenville	58,077	58,397	58,765	58,977	59,333	59,696	60,062	60,418	60,762	61,102	61,436
Kershaw	5,823	5,873	5,916	5,946	5,990	6,035	6,080	6,124	6,166	6,207	6,248
Lexington	25,559	25,748	25,980	26,156	26,330	26,499	26,665	26,832	26,993	27,159	27,320
Richland	36,866	37,090	37,316	37,482	37,680	37,870	38,057	38,241	38,419	38,592	38,763
Spartanburg	31,846	32,025	32,260	32,394	32,706	33,012	33,319	33,630	33,946	34,260	34,579
York	22,976	23,165	23,363	23,467	23,612	23,757	23,895	24,032	24,166	24,303	24,432

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:		
	2/5	2/6	2/7	2/8	2/10	2/12	2/14
Beaufort	14,062	14,135	14,215	14,264	14,458 (2,892) [694] {347}	14,651 (2,930) [703] {352}	14,839 (2,968) [712] {356}
Charleston	34,062	34,332	34,589	34,748	35,232 (7,046) [1,691] {846}	35,712 (7,142) [1,714] {857}	36,190 (7,238) [1,737] {869}
Greenville	58,077	58,397	58,765	58,977	59,696 (11,939) [2,865] {1,433}	60,418 (12,084) [2,900] {1,450}	61,102 (12,220) [2,933] {1,466}
Kershaw	5,823	5,873	5,916	5,946	6,035 (1,207) [290] {145}	6,124 (1,225) [294] {147}	6,207 (1,241) [298] {149}
Lexington	25,559	25,748	25,980	26,156	26,499 (5,300) [1,272] {636}	26,832 (5,366) [1,288] {644}	27,159 (5,432) [1,304] {652}
Richland	36,866	37,090	37,316	37,482	37,870 (7,574) [1,818] {909}	38,241 (7,648) [1,836] {918}	38,592 (7,718) [1,852] {926}
Spartanburg	31,846	32,025	32,260	32,394	33,012 (6,602) [1,585] {792}	33,630 (6,726) [1,614] {807}	34,260 (6,852) [1,644] {822}
York	22,976	23,165	23,363	23,467	23,757 (4,751) [1,140] {570}	24,032 (4,806) [1,154] {577}	24,303 (4,861) [1,167] {583}

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.