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

Date: 5/3/21

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 5/3/21 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.

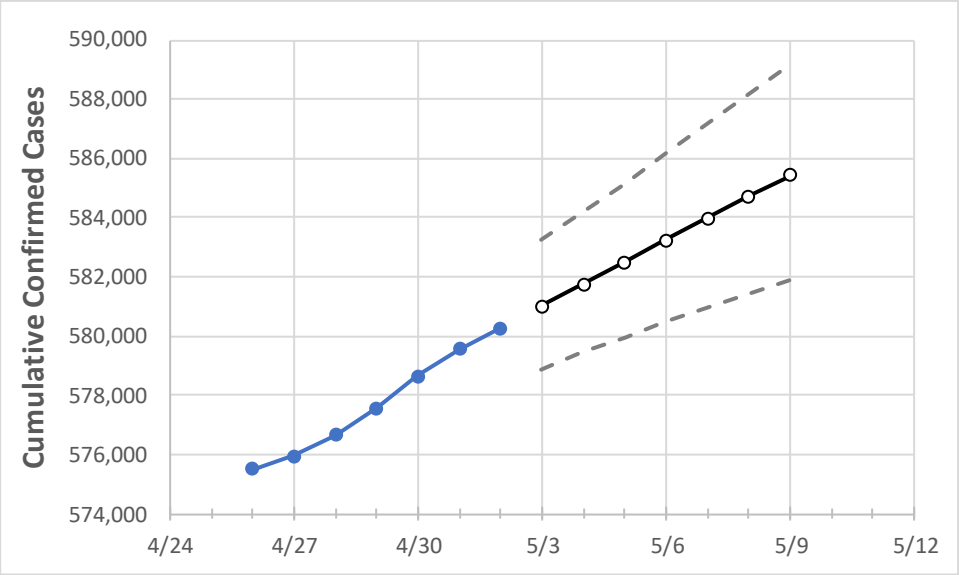
IEM's Modeling Lead

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:						
	4/29	4/30	5/1	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9
South Carolina	577,550	578,659	579,556	580,273	581,025	581,765	582,509	583,249	583,982	584,708	585,431

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:						
	4/29	4/30	5/1	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9
Beaufort	16,653	16,668	16,692	16,702	16,713	16,725	16,735	16,747	16,758	16,769	16,780
Charleston	42,615	42,727	42,785	42,841	42,899	42,954	43,010	43,067	43,121	43,175	43,228
Greenville	73,368	73,496	73,561	73,669	73,748	73,825	73,902	73,977	74,050	74,121	74,192
Kershaw	7,393	7,403	7,415	7,428	7,440	7,453	7,465	7,478	7,491	7,504	7,517
Lexington	32,950	32,992	33,028	33,060	33,092	33,122	33,151	33,180	33,208	33,235	33,261
Richland	45,859	45,937	46,053	46,113	46,173	46,234	46,292	46,353	46,414	46,473	46,534
Spartanburg	40,742	40,791	40,824	40,888	40,931	40,974	41,017	41,058	41,100	41,142	41,184
York	30,497	30,574	30,720	30,774	30,844	30,913	30,982	31,051	31,121	31,189	31,260

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:		
	4/29	4/30	5/1	5/2	5/4	5/6	5/8
Beaufort	16,653	16,668	16,692	16,702	16,725 (3,345) [803] {401}	16,747 (3,349) [804] {402}	16,769 (3,354) [805] {402}
Charleston	42,615	42,727	42,785	42,841	42,954 (8,591) [2,062] {1,031}	43,067 (8,613) [2,067] {1,034}	43,175 (8,635) [2,072] {1,036}
Greenville	73,368	73,496	73,561	73,669	73,825 (14,765) [3,544] {1,772}	73,977 (14,795) [3,551] {1,775}	74,121 (14,824) [3,558] {1,779}
Kershaw	7,393	7,403	7,415	7,428	7,453 (1,491) [358] {179}	7,478 (1,496) [359] {179}	7,504 (1,501) [360] {180}
Lexington	32,950	32,992	33,028	33,060	33,122 (6,624) [1,590] {795}	33,180 (6,636) [1,593] {796}	33,235 (6,647) [1,595] {798}
Richland	45,859	45,937	46,053	46,113	46,234 (9,247) [2,219] {1,110}	46,353 (9,271) [2,225] {1,112}	46,473 (9,295) [2,231] {1,115}
Spartanburg	40,742	40,791	40,824	40,888	40,974 (8,195) [1,967] {983}	41,058 (8,212) [1,971] {985}	41,142 (8,228) [1,975] {987}
York	30,497	30,574	30,720	30,774	30,913 (6,183) [1,484] {742}	31,051 (6,210) [1,490] {745}	31,189 (6,238) [1,497] {749}

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.