

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

Date: 4/21/21

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 4/21/21 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.

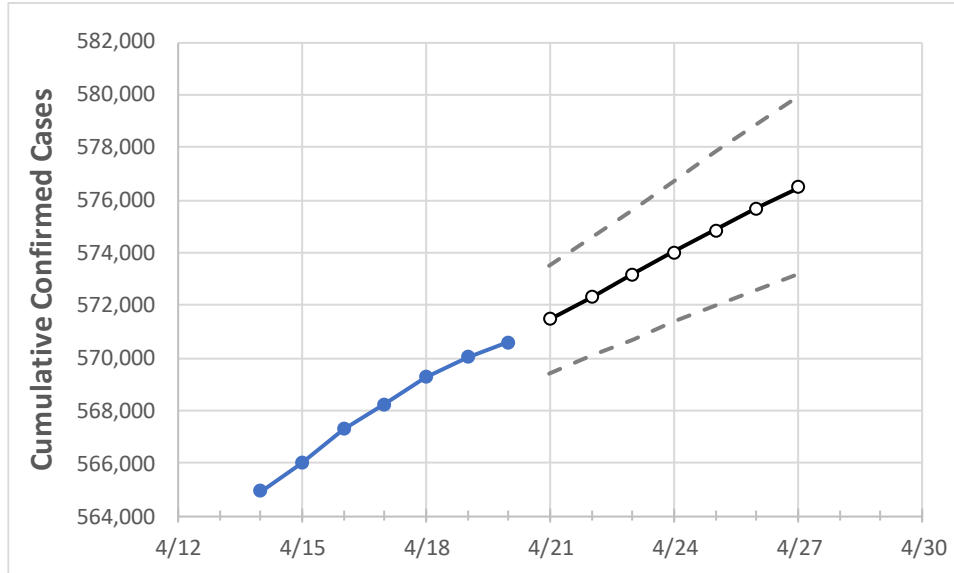
IEM's Modeling Lead

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:						
	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27

South Carolina 568,258 569,279 570,032 570,606 571,463 572,322 573,160 574,012 574,850 575,675 576,491

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:						
	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27
Beaufort	16,521	16,534	16,545	16,550	16,561	16,572	16,582	16,592	16,602	16,611	16,621
Charleston	41,917	42,004	42,075	42,123	42,196	42,271	42,344	42,419	42,494	42,569	42,644
Greenville	72,210	72,343	72,458	72,543	72,648	72,754	72,854	72,952	73,044	73,132	73,221
Kershaw	7,247	7,253	7,272	7,279	7,292	7,306	7,320	7,334	7,348	7,363	7,378
Lexington	32,497	32,548	32,591	32,614	32,665	32,716	32,768	32,820	32,871	32,922	32,973
Richland	45,147	45,230	45,287	45,320	45,395	45,471	45,547	45,622	45,699	45,776	45,853
Spartanburg	40,154	40,224	40,270	40,310	40,353	40,395	40,435	40,474	40,513	40,551	40,584
York	29,769	29,827	29,879	29,929	29,998	30,066	30,134	30,201	30,269	30,338	30,409

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:											
	4/17	4/18	4/19	4/20	4/22			4/24			4/26					
Beaufort	16,521	16,534	16,545	16,550	16,572	(3,314)	[795]	{398}	16,592	(3,318)	[796]	{398}	16,611	(3,322)	[797]	{399}
Charleston	41,917	42,004	42,075	42,123	42,271	(8,454)	[2,029]	{1,015}	42,419	(8,484)	[2,036]	{1,018}	42,569	(8,514)	[2,043]	{1,022}
Greenville	72,210	72,343	72,458	72,543	72,754	(14,551)	[3,492]	{1,746}	72,952	(14,590)	[3,502]	{1,751}	73,132	(14,626)	[3,510]	{1,755}
Kershaw	7,247	7,253	7,272	7,279	7,306	(1,461)	[351]	{175}	7,334	(1,467)	[352]	{176}	7,363	(1,473)	[353]	{177}
Lexington	32,497	32,548	32,591	32,614	32,716	(6,543)	[1,570]	{785}	32,820	(6,564)	[1,575]	{788}	32,922	(6,584)	[1,580]	{790}
Richland	45,147	45,230	45,287	45,320	45,471	(9,094)	[2,183]	{1,091}	45,622	(9,124)	[2,190]	{1,095}	45,776	(9,155)	[2,197]	{1,099}
Spartanburg	40,154	40,224	40,270	40,310	40,395	(8,079)	[1,939]	{969}	40,474	(8,095)	[1,943]	{971}	40,551	(8,110)	[1,946]	{973}
York	29,769	29,827	29,879	29,929	30,066	(6,013)	[1,443]	{722}	30,201	(6,040)	[1,450]	{725}	30,338	(6,068)	[1,456]	{728}

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.