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

Date: 9/13/21

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 9/13/21 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.

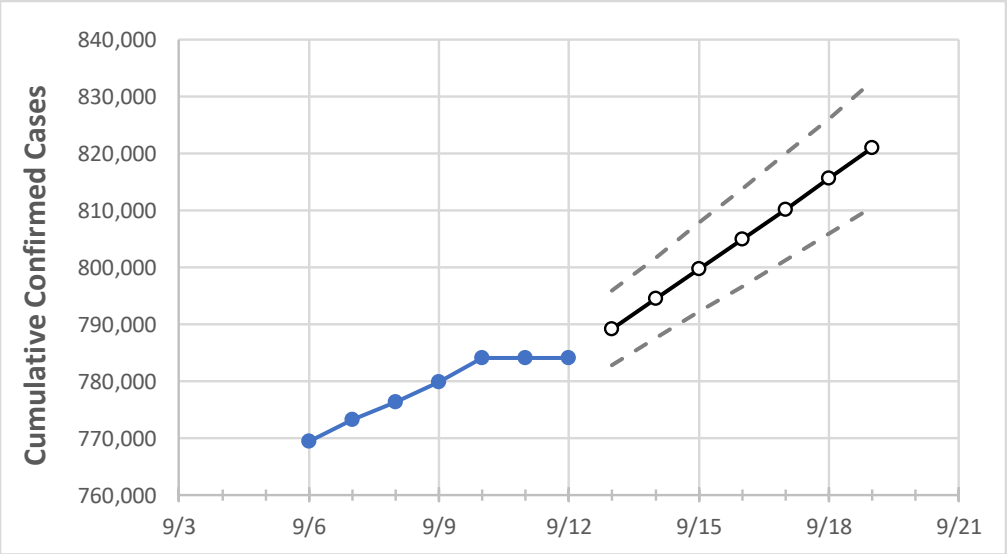
IEM's Modeling Lead

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:						
	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16	9/17	9/18	9/19
South Carolina	779,898	784,052	784,052	784,052	789,222	794,506	799,791	804,981	810,216	815,671	821,024

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:						
	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16	9/17	9/18	9/19
Beaufort	24,432	24,511	24,511	24,511	24,647	24,779	24,912	25,044	25,175	25,305	25,431
Charleston	58,552	58,855	58,855	58,855	59,179	59,490	59,799	60,111	60,422	60,734	61,033
Greenville	91,591	91,997	91,997	91,997	92,535	93,088	93,630	94,178	94,737	95,309	95,866
Kershaw	10,280	10,387	10,387	10,387	10,446	10,504	10,562	10,621	10,679	10,738	10,796
Lexington	47,570	47,913	47,913	47,913	48,272	48,626	48,980	49,334	49,698	50,047	50,412
Richland	60,709	60,988	60,988	60,988	61,262	61,542	61,817	62,091	62,364	62,648	62,923
Spartanburg	52,606	52,796	52,796	52,796	53,197	53,613	54,018	54,436	54,860	55,291	55,721
York	40,967	41,162	41,162	41,162	41,480	41,811	42,137	42,465	42,810	43,157	43,519

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:		
	9/9	9/10	9/11	9/12	9/14	9/16	9/18
Beaufort	24,432	24,511	24,511	24,511	24,779 (4,956) [1,189] {595}	25,044 (5,009) [1,202] {601}	25,305 (5,061) [1,215] {607}
Charleston	58,552	58,855	58,855	58,855	59,490 (11,898) [2,856] {1,428}	60,111 (12,022) [2,885] {1,443}	60,734 (12,147) [2,915] {1,458}
Greenville	91,591	91,997	91,997	91,997	93,088 (18,618) [4,468] {2,234}	94,178 (18,836) [4,521] {2,260}	95,309 (19,062) [4,575] {2,287}
Kershaw	10,280	10,387	10,387	10,387	10,504 (2,101) [504] {252}	10,621 (2,124) [510] {255}	10,738 (2,148) [515] {258}
Lexington	47,570	47,913	47,913	47,913	48,626 (9,725) [2,334] {1,167}	49,334 (9,867) [2,368] {1,184}	50,047 (10,009) [2,402] {1,201}
Richland	60,709	60,988	60,988	60,988	61,542 (12,308) [2,954] {1,477}	62,091 (12,418) [2,980] {1,490}	62,648 (12,530) [3,007] {1,504}
Spartanburg	52,606	52,796	52,796	52,796	53,613 (10,723) [2,573] {1,287}	54,436 (10,887) [2,613] {1,306}	55,291 (11,058) [2,654] {1,327}
York	40,967	41,162	41,162	41,162	41,811 (8,362) [2,007] {1,003}	42,465 (8,493) [2,038] {1,019}	43,157 (8,631) [2,072] {1,036}

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.