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

Date: 12/14/20

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 12/14/20 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.

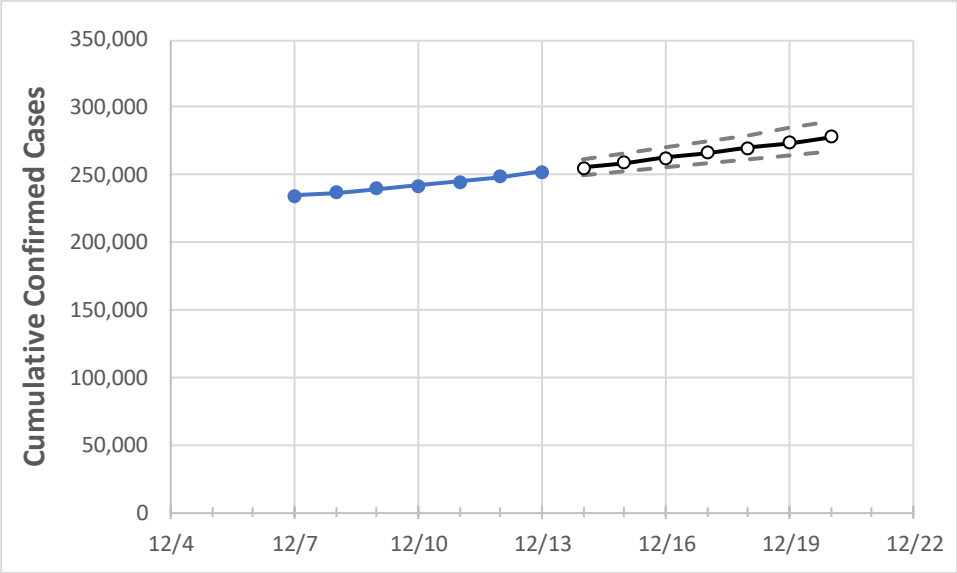
IEM's Modeling Lead

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:						
	12/10	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20
South Carolina	241,686	245,226	248,798	252,206	255,459	258,845	262,369	266,036	269,852	273,822	277,952

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 20%, and are often within 10%, of actual confirmed cases.

South Carolina Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	12/10	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20
Beaufort	7,766	7,870	7,954	8,059	8,149	8,245	8,346	8,453	8,566	8,685	8,811
Charleston	21,236	21,356	21,541	21,696	21,827	21,960	22,097	22,236	22,378	22,523	22,670
Greenville	27,396	27,935	28,453	28,956	29,427	29,918	30,431	30,965	31,521	32,102	32,706
Kershaw	3,202	3,228	3,276	3,297	3,325	3,354	3,385	3,416	3,449	3,484	3,520
Lexington	12,690	12,846	13,044	13,239	13,410	13,589	13,775	13,970	14,174	14,386	14,608
Richland	22,183	22,375	22,650	22,874	23,104	23,344	23,595	23,857	24,131	24,417	24,716
Spartanburg	14,560	14,927	15,168	15,515	15,806	16,113	16,434	16,773	17,128	17,501	17,892
York	11,488	11,747	11,932	12,097	12,303	12,516	12,737	12,964	13,199	13,443	13,694

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:		
	12/10	12/11	12/12	12/13	12/15	12/17	12/19
Beaufort	7,766	7,870	7,954	8,059	8,245 (1,649) [396] {198}	8,453 (1,691) [406] {203}	8,685 (1,737) [417] {208}
Charleston	21,236	21,356	21,541	21,696	21,960 (4,392) [1,054] {527}	22,236 (4,447) [1,067] {534}	22,523 (4,505) [1,081] {541}
Greenville	27,396	27,935	28,453	28,956	29,918 (5,984) [1,436] {718}	30,965 (6,193) [1,486] {743}	32,102 (6,420) [1,541] {770}
Kershaw	3,202	3,228	3,276	3,297	3,354 (671) [161] {81}	3,416 (683) [164] {82}	3,484 (697) [167] {84}
Lexington	12,690	12,846	13,044	13,239	13,589 (2,718) [652] {326}	13,970 (2,794) [671] {335}	14,386 (2,877) [691] {345}
Richland	22,183	22,375	22,650	22,874	23,344 (4,669) [1,121] {560}	23,857 (4,771) [1,145] {573}	24,417 (4,883) [1,172] {586}
Spartanburg	14,560	14,927	15,168	15,515	16,113 (3,223) [773] {387}	16,773 (3,355) [805] {403}	17,501 (3,500) [840] {420}
York	11,488	11,747	11,932	12,097	12,516 (2,503) [601] {300}	12,964 (2,593) [622] {311}	13,443 (2,689) [645] {323}

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.