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

Date: 12/22/21

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 12/22/21 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.

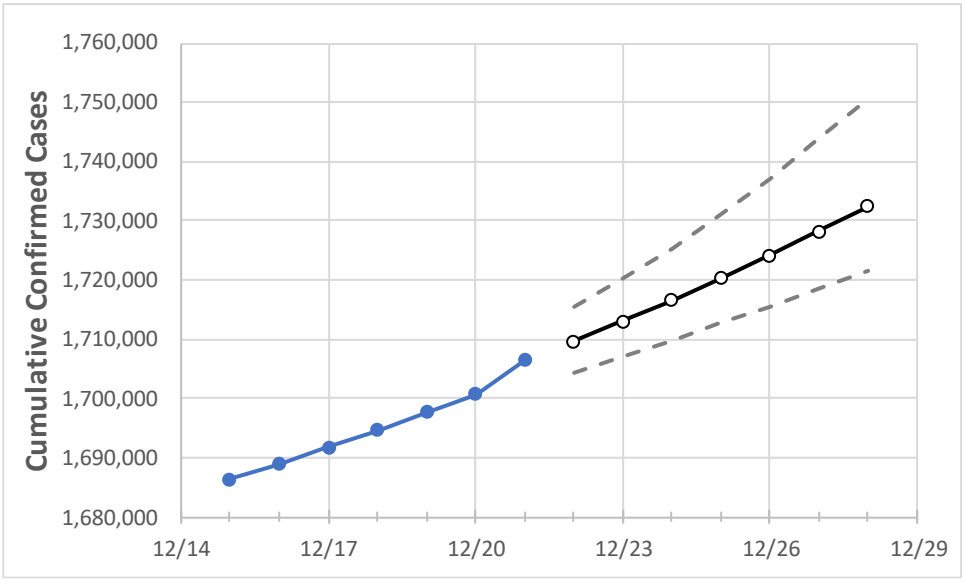
IEM's Modeling Lead

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.

Georgia State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	12/18	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27	12/28
Georgia	1,694,704	1,697,733	1,700,763	1,706,483	1,709,713	1,713,048	1,716,518	1,720,260	1,724,125	1,728,203	1,732,372

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.

Georgia Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	12/18	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27	12/28
Bartow	21,261	21,296	21,332	21,393	21,430	21,469	21,509	21,550	21,593	21,639	21,684
Carroll	16,918	16,951	16,983	17,051	17,081	17,113	17,146	17,179	17,215	17,254	17,292
Cherokee	45,319	45,383	45,448	45,581	45,654	45,731	45,808	45,890	45,974	46,063	46,151
Clarke	20,632	20,653	20,675	20,714	20,738	20,763	20,789	20,816	20,844	20,873	20,903
Clayton	41,294	41,426	41,559	41,808	41,959	42,114	42,277	42,445	42,629	42,822	43,023
Cobb	114,681	115,032	115,384	115,957	116,298	116,658	117,020	117,402	117,818	118,245	118,686
DeKalb	95,684	95,940	96,197	96,664	96,944	97,249	97,559	97,890	98,236	98,612	98,998
Dougherty	12,607	12,614	12,621	12,631	12,638	12,645	12,652	12,659	12,667	12,675	12,683
Douglas	23,141	23,194	23,246	23,352	23,406	23,463	23,523	23,587	23,653	23,722	23,796
Fulton	138,685	139,257	139,828	140,754	141,369	142,009	142,678	143,398	144,179	144,995	145,849
Gwinnett	139,273	139,538	139,804	140,345	140,640	140,935	141,252	141,580	141,916	142,270	142,637
Hall	39,860	39,902	39,944	40,010	40,063	40,117	40,170	40,226	40,282	40,338	40,395
Henry	39,753	39,845	39,936	40,107	40,197	40,285	40,380	40,477	40,579	40,687	40,799
Lee	4,860	4,862	4,864	4,873	4,879	4,885	4,891	4,897	4,903	4,910	4,917

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.*

Georgia Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	12/18	12/19	12/20	12/21	12/23	12/25	12/27
Bartow	21,261	21,296	21,332	21,393	21,469 (4,294) [1,031] {515}	21,550 (4,310) [1,034] {517}	21,639 (4,328) [1,039] {519}
Carroll	16,918	16,951	16,983	17,051	17,113 (3,423) [821] {411}	17,179 (3,436) [825] {412}	17,254 (3,451) [828] {414}
Cherokee	45,319	45,383	45,448	45,581	45,731 (9,146) [2,195] {1,098}	45,890 (9,178) [2,203] {1,101}	46,063 (9,213) [2,211] {1,106}
Clarke	20,632	20,653	20,675	20,714	20,763 (4,153) [997] {498}	20,816 (4,163) [999] {500}	20,873 (4,175) [1,002] {501}
Clayton	41,294	41,426	41,559	41,808	42,114 (8,423) [2,021] {1,011}	42,445 (8,489) [2,037] {1,019}	42,822 (8,564) [2,055] {1,028}
Cobb	114,681	115,032	115,384	115,957	116,658 (23,332) [5,600] {2,800}	117,402 (23,480) [5,635] {2,818}	118,245 (23,649) [5,676] {2,838}
DeKalb	95,684	95,940	96,197	96,664	97,249 (19,450) [4,668] {2,334}	97,890 (19,578) [4,699] {2,349}	98,612 (19,722) [4,733] {2,367}
Dougherty	12,607	12,614	12,621	12,631	12,645 (2,529) [607] {303}	12,659 (2,532) [608] {304}	12,675 (2,535) [608] {304}
Douglas	23,141	23,194	23,246	23,352	23,463 (4,693) [1,126] {563}	23,587 (4,717) [1,132] {566}	23,722 (4,744) [1,139] {569}
Fulton	138,685	139,257	139,828	140,754	142,009 (28,402) [6,816] {3,408}	143,398 (28,680) [6,883] {3,442}	144,995 (28,999) [6,960] {3,480}
Gwinnett	139,273	139,538	139,804	140,345	140,935 (28,187) [6,765] {3,382}	141,580 (28,316) [6,796] {3,398}	142,270 (28,454) [6,829] {3,414}
Hall	39,860	39,902	39,944	40,010	40,117 (8,023) [1,926] {963}	40,226 (8,045) [1,931] {965}	40,338 (8,068) [1,936] {968}
Henry	39,753	39,845	39,936	40,107	40,285 (8,057) [1,934] {967}	40,477 (8,095) [1,943] {971}	40,687 (8,137) [1,953] {976}
Lee	4,860	4,862	4,864	4,873	4,885 (977) [234] {117}	4,897 (979) [235] {118}	4,910 (982) [236] {118}

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.