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

Date: 1/14/22

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 1/14/22 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.

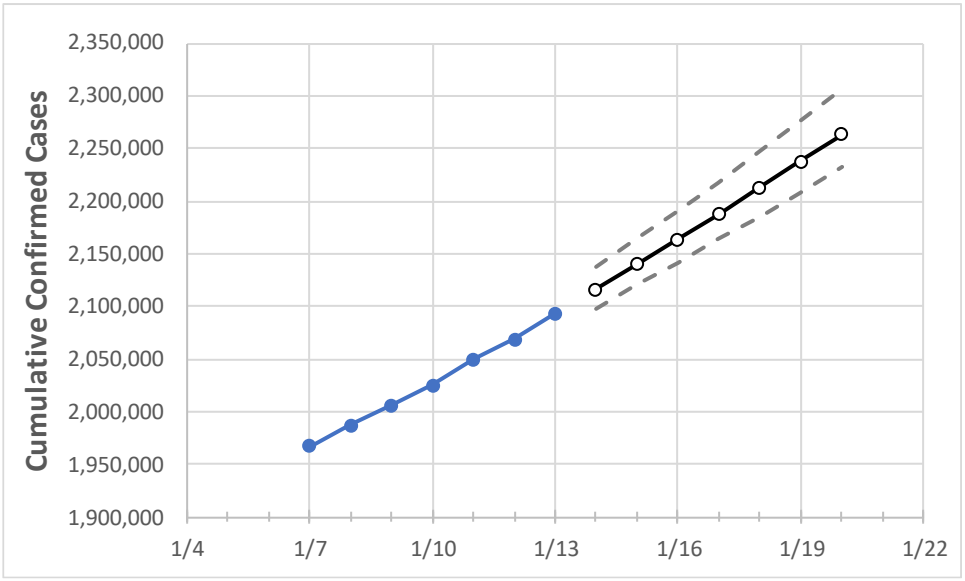
IEM's Modeling Lead

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:						
	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19	1/20
Georgia	2,025,262	2,050,127	2,069,066	2,093,376	2,116,532	2,139,788	2,163,858	2,187,838	2,212,687	2,238,106	2,263,445

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:						
	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19	1/20
Bartow	24,608	24,838	25,037	25,213	25,409	25,613	25,812	26,016	26,223	26,434	26,645
Carroll	20,148	20,429	20,556	20,742	20,943	21,151	21,358	21,569	21,787	22,007	22,232
Cherokee	52,878	53,502	54,030	54,649	55,211	55,777	56,360	56,961	57,567	58,199	58,831
Clarke	24,511	24,841	25,029	25,327	25,634	25,952	26,268	26,602	26,949	27,299	27,670
Clayton	52,424	52,786	53,113	53,841	54,397	54,953	55,513	56,068	56,629	57,206	57,773
Cobb	142,791	144,257	145,682	147,210	148,593	149,929	151,296	152,653	153,987	155,347	156,710
DeKalb	119,469	120,697	121,502	122,770	124,016	125,250	126,497	127,740	128,999	130,279	131,553
Dougherty	14,267	14,543	14,706	14,975	15,208	15,454	15,719	15,997	16,296	16,619	16,956
Douglas	30,065	30,386	30,666	30,903	31,246	31,585	31,925	32,262	32,605	32,945	33,290
Fulton	180,426	182,019	183,410	185,008	186,792	188,540	190,250	191,960	193,673	195,405	197,085
Gwinnett	170,542	172,346	173,403	175,496	177,435	179,415	181,358	183,414	185,459	187,597	189,692
Hall	45,181	45,803	46,070	46,586	47,138	47,707	48,292	48,920	49,572	50,263	50,970
Henry	50,196	50,723	51,016	51,478	51,985	52,492	52,988	53,486	54,006	54,512	55,024
Lee	5,309	5,371	5,417	5,495	5,551	5,612	5,675	5,743	5,815	5,891	5,970

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:		
	1/10	1/11	1/12	1/13	1/15	1/17	1/19
Bartow	24,608	24,838	25,037	25,213	25,613 (5,123) [1,229] {615}	26,016 (5,203) [1,249] {624}	26,434 (5,287) [1,269] {634}
Carroll	20,148	20,429	20,556	20,742	21,151 (4,230) [1,015] {508}	21,569 (4,314) [1,035] {518}	22,007 (4,401) [1,056] {528}
Cherokee	52,878	53,502	54,030	54,649	55,777 (11,155) [2,677] {1,339}	56,961 (11,392) [2,734] {1,367}	58,199 (11,640) [2,794] {1,397}
Clarke	24,511	24,841	25,029	25,327	25,952 (5,190) [1,246] {623}	26,602 (5,320) [1,277] {638}	27,299 (5,460) [1,310] {655}
Clayton	52,424	52,786	53,113	53,841	54,953 (10,991) [2,638] {1,319}	56,068 (11,214) [2,691] {1,346}	57,206 (11,441) [2,746] {1,373}
Cobb	142,791	144,257	145,682	147,210	149,929 (29,986) [7,197] {3,598}	152,653 (30,531) [7,327] {3,664}	155,347 (31,069) [7,457] {3,728}
DeKalb	119,469	120,697	121,502	122,770	125,250 (25,050) [6,012] {3,006}	127,740 (25,548) [6,132] {3,066}	130,279 (26,056) [6,253] {3,127}
Dougherty	14,267	14,543	14,706	14,975	15,454 (3,091) [742] {371}	15,997 (3,199) [768] {384}	16,619 (3,324) [798] {399}
Douglas	30,065	30,386	30,666	30,903	31,585 (6,317) [1,516] {758}	32,262 (6,452) [1,549] {774}	32,945 (6,589) [1,581] {791}
Fulton	180,426	182,019	183,410	185,008	188,540 (37,708) [9,050] {4,525}	191,960 (38,392) [9,214] {4,607}	195,405 (39,081) [9,379] {4,690}
Gwinnett	170,542	172,346	173,403	175,496	179,415 (35,883) [8,612] {4,306}	183,414 (36,683) [8,804] {4,402}	187,597 (37,519) [9,005] {4,502}
Hall	45,181	45,803	46,070	46,586	47,707 (9,541) [2,290] {1,145}	48,920 (9,784) [2,348] {1,174}	50,263 (10,053) [2,413] {1,206}
Henry	50,196	50,723	51,016	51,478	52,492 (10,498) [2,520] {1,260}	53,486 (10,697) [2,567] {1,284}	54,512 (10,902) [2,617] {1,308}
Lee	5,309	5,371	5,417	5,495	5,612 (1,122) [269] {135}	5,743 (1,149) [276] {138}	5,891 (1,178) [283] {141}

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.