IEM's AI Modeling: Short-term COVID-19 Projections
Date: 5/12/21

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 <u>not</u> 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 5/12/21 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.
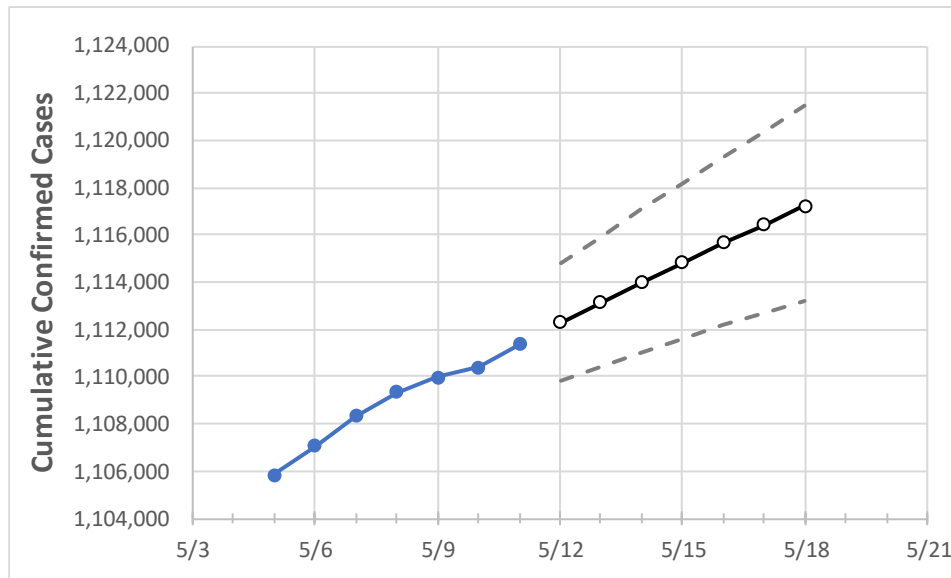
IEM's Modeling Lead

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:						
	5/8	5/9	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18
Georgia	1,109,330	1,109,958	1,110,418	1,111,376	1,112,293	1,113,157	1,113,997	1,114,835	1,115,654	1,116,446	1,117,230

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:						
	5/8	5/9	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18
Bartow	14,629	14,636	14,640	14,655	14,662	14,669	14,677	14,683	14,690	14,696	14,701
Carroll	11,350	11,354	11,358	11,366	11,373	11,380	11,387	11,394	11,402	11,408	11,415
Cherokee	30,969	30,983	30,994	31,014	31,041	31,067	31,094	31,120	31,145	31,170	31,194
Clarke	15,025	15,034	15,036	15,042	15,049	15,055	15,062	15,068	15,074	15,079	15,085
Clayton	26,616	26,638	26,659	26,710	26,748	26,784	26,819	26,853	26,887	26,922	26,955
Cobb	78,375	78,431	78,463	78,529	78,600	78,668	78,734	78,800	78,864	78,926	78,983
DeKalb	65,809	65,851	65,896	65,929	66,013	66,096	66,176	66,257	66,334	66,411	66,487
Dougherty	7,550	7,553	7,556	7,562	7,568	7,574	7,580	7,586	7,592	7,597	7,603
Douglas	15,183	15,197	15,207	15,229	15,246	15,262	15,277	15,293	15,308	15,324	15,339
Fulton	97,143	97,209	97,255	97,343	97,431	97,517	97,601	97,683	97,760	97,835	97,909
Gwinnett	101,411	101,455	101,495	101,562	101,623	101,682	101,738	101,793	101,845	101,893	101,939
Hall	27,231	27,242	27,254	27,268	27,290	27,312	27,334	27,355	27,377	27,397	27,419
Henry	25,220	25,234	25,248	25,269	25,292	25,315	25,337	25,357	25,377	25,396	25,415
Lee	2,735	2,738	2,740	2,741	2,744	2,747	2,750	2,753	2,756	2,759	2,763

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:		
	5/8	5/9	5/10	5/11	5/13	5/15	5/17
Bartow	14,629	14,636	14,640	14,655	14,669 (2,934) [704] {352}	14,683 (2,937) [705] {352}	14,696 (2,939) [705] {353}
Carroll	11,350	11,354	11,358	11,366	11,380 (2,276) [546] {273}	11,394 (2,279) [547] {273}	11,408 (2,282) [548] {274}
Cherokee	30,969	30,983	30,994	31,014	31,067 (6,213) [1,491] {746}	31,120 (6,224) [1,494] {747}	31,170 (6,234) [1,496] {748}
Clarke	15,025	15,034	15,036	15,042	15,055 (3,011) [723] {361}	15,068 (3,014) [723] {362}	15,079 (3,016) [724] {362}
Clayton	26,616	26,638	26,659	26,710	26,784 (5,357) [1,286] {643}	26,853 (5,371) [1,289] {644}	26,922 (5,384) [1,292] {646}
Cobb	78,375	78,431	78,463	78,529	78,668 (15,734) [3,776] {1,888}	78,800 (15,760) [3,782] {1,891}	78,926 (15,785) [3,788] {1,894}
DeKalb	65,809	65,851	65,896	65,929	66,096 (13,219) [3,173] {1,586}	66,257 (13,251) [3,180] {1,590}	66,411 (13,282) [3,188] {1,594}
Dougherty	7,550	7,553	7,556	7,562	7,574 (1,515) [364] {182}	7,586 (1,517) [364] {182}	7,597 (1,519) [365] {182}
Douglas	15,183	15,197	15,207	15,229	15,262 (3,052) [733] {366}	15,293 (3,059) [734] {367}	15,324 (3,065) [736] {368}
Fulton	97,143	97,209	97,255	97,343	97,517 (19,503) [4,681] {2,340}	97,683 (19,537) [4,689] {2,344}	97,835 (19,567) [4,696] {2,348}
Gwinnett	101,411	101,455	101,495	101,562	101,682 (20,336) [4,881] {2,440}	101,793 (20,359) [4,886] {2,443}	101,893 (20,379) [4,891] {2,445}
Hall	27,231	27,242	27,254	27,268	27,312 (5,462) [1,311] {655}	27,355 (5,471) [1,313] {657}	27,397 (5,479) [1,315] {658}
Henry	25,220	25,234	25,248	25,269	25,315 (5,063) [1,215] {608}	25,357 (5,071) [1,217] {609}	25,396 (5,079) [1,219] {610}
Lee	2,735	2,738	2,740	2,741	2,747 (549) [132] {66}	2,753 (551) [132] {66}	2,759 (552) [132] {66}

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.