IEM's AI Modeling: Short-term COVID-19 Projections
Date: 1/4/21

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 1/4/21 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
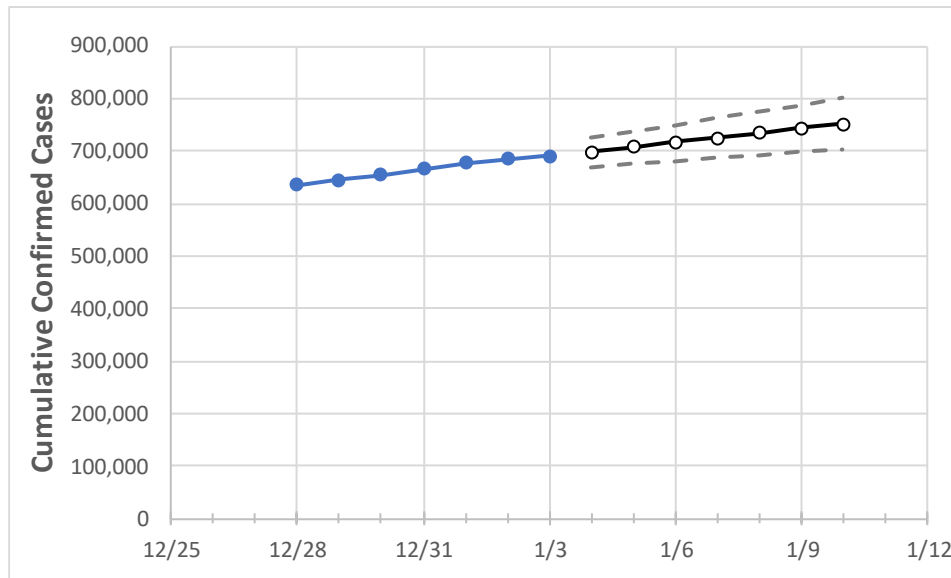
	Actual Confirmed Cases On:				Projected Cases For:						
	12/31	1/1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10
Georgia	666,452	677,589	685,122	690,900	699,146	707,664	716,302	725,075	734,053	743,064	752,066

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:						
	12/31	1/1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10
Bartow	7,928	8,062	8,135	8,234	8,345	8,459	8,572	8,689	8,811	8,933	9,055
Carroll	7,610	7,675	7,754	7,799	7,860	7,921	7,983	8,044	8,107	8,170	8,233
Cherokee	16,418	16,869	17,050	17,267	17,559	17,863	18,180	18,496	18,820	19,159	19,504
Clarke	10,083	10,184	10,291	10,388	10,471	10,556	10,642	10,730	10,813	10,906	10,995
Clayton	14,398	14,623	14,756	14,864	15,009	15,153	15,297	15,445	15,593	15,750	15,899
Cobb	44,195	45,028	45,705	46,159	46,746	47,341	47,947	48,552	49,191	49,808	50,461
DeKalb	38,135	38,737	39,134	39,333	39,707	40,107	40,506	40,899	41,319	41,738	42,151
Dougherty	4,744	4,829	4,846	4,865	4,902	4,938	4,976	5,015	5,054	5,093	5,133
Douglas	8,249	8,425	8,539	8,650	8,748	8,850	8,953	9,057	9,165	9,271	9,381
Fulton	56,781	57,724	58,438	58,829	59,448	60,084	60,714	61,370	61,996	62,673	63,345
Gwinnett	57,492	58,565	59,163	59,683	60,422	61,176	61,954	62,756	63,553	64,347	65,166
Hall	18,345	18,627	18,770	18,854	19,033	19,208	19,384	19,567	19,752	19,937	20,120
Henry	13,434	13,699	13,847	13,967	14,161	14,359	14,564	14,768	14,980	15,189	15,405
Lee	1,539	1,567	1,578	1,585	1,608	1,631	1,656	1,683	1,708	1,735	1,762

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:		
	12/31	1/1	1/2	1/3	1/5	1/7	1/9
Bartow	7,928	8,062	8,135	8,234	8,459 (1,692) [406] {203}	8,689 (1,738) [417] {209}	8,933 (1,787) [429] {214}
Carroll	7,610	7,675	7,754	7,799	7,921 (1,584) [380] {190}	8,044 (1,609) [386] {193}	8,170 (1,634) [392] {196}
Cherokee	16,418	16,869	17,050	17,267	17,863 (3,573) [857] {429}	18,496 (3,699) [888] {444}	19,159 (3,832) [920] {460}
Clarke	10,083	10,184	10,291	10,388	10,556 (2,111) [507] {253}	10,730 (2,146) [515] {258}	10,906 (2,181) [523] {262}
Clayton	14,398	14,623	14,756	14,864	15,153 (3,031) [727] {364}	15,445 (3,089) [741] {371}	15,750 (3,150) [756] {378}
Cobb	44,195	45,028	45,705	46,159	47,341 (9,468) [2,272] {1,136}	48,552 (9,710) [2,331] {1,165}	49,808 (9,962) [2,391] {1,195}
DeKalb	38,135	38,737	39,134	39,333	40,107 (8,021) [1,925] {963}	40,899 (8,180) [1,963] {982}	41,738 (8,348) [2,003] {1,002}
Dougherty	4,744	4,829	4,846	4,865	4,938 (988) [237] {119}	5,015 (1,003) [241] {120}	5,093 (1,019) [244] {122}
Douglas	8,249	8,425	8,539	8,650	8,850 (1,770) [425] {212}	9,057 (1,811) [435] {217}	9,271 (1,854) [445] {223}
Fulton	56,781	57,724	58,438	58,829	60,084 (12,017) [2,884] {1,442}	61,370 (12,274) [2,946] {1,473}	62,673 (12,535) [3,008] {1,504}
Gwinnett	57,492	58,565	59,163	59,683	61,176 (12,235) [2,936] {1,468}	62,756 (12,551) [3,012] {1,506}	64,347 (12,869) [3,089] {1,544}
Hall	18,345	18,627	18,770	18,854	19,208 (3,842) [922] {461}	19,567 (3,913) [939] {470}	19,937 (3,987) [957] {478}
Henry	13,434	13,699	13,847	13,967	14,359 (2,872) [689] {345}	14,768 (2,954) [709] {354}	15,189 (3,038) [729] {365}
Lee	1,539	1,567	1,578	1,585	1,631 (326) [78] {39}	1,683 (337) [81] {40}	1,735 (347) [83] {42}

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.