IEM's AI Modeling: Short-term COVID-19 Projections
Date: 3/12/21

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 3/12/21 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
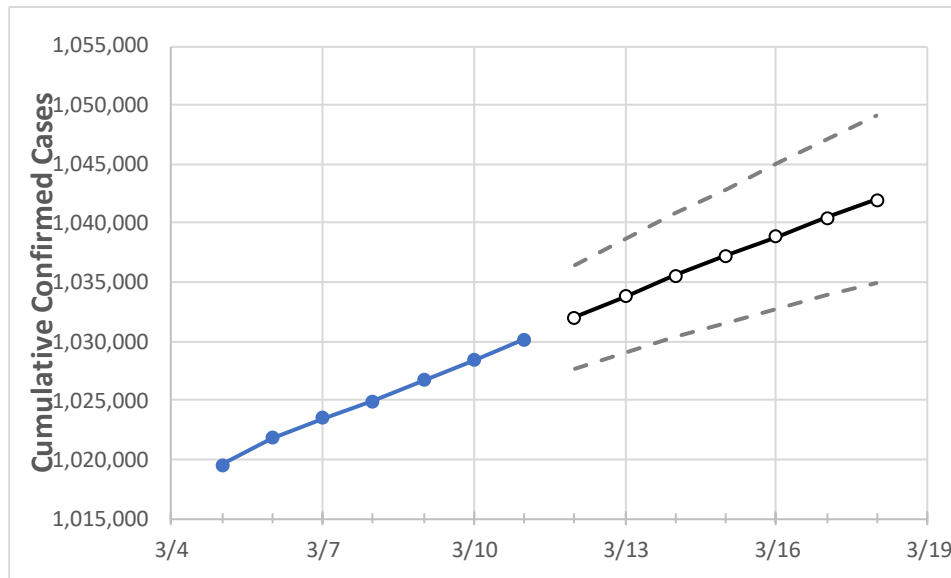
	Actual Confirmed Cases On:				Projected Cases For:						
	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16	3/17	3/18
Georgia	1,024,931	1,026,692	1,028,432	1,030,146	1,032,013	1,033,809	1,035,527	1,037,216	1,038,868	1,040,433	1,041,958

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:						
	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16	3/17	3/18
Bartow	13,257	13,288	13,323	13,361	13,388	13,414	13,439	13,463	13,485	13,507	13,529
Carroll	10,650	10,660	10,669	10,686	10,695	10,704	10,712	10,720	10,728	10,735	10,742
Cherokee	27,956	28,042	28,116	28,184	28,244	28,301	28,359	28,414	28,468	28,518	28,568
Clarke	14,289	14,306	14,339	14,365	14,386	14,407	14,427	14,447	14,466	14,485	14,505
Clayton	23,706	23,757	23,822	23,874	23,924	23,972	24,019	24,063	24,108	24,151	24,193
Cobb	70,920	71,071	71,190	71,304	71,445	71,582	71,715	71,846	71,969	72,090	72,207
DeKalb	58,234	58,357	58,493	58,629	58,765	58,901	59,033	59,163	59,292	59,417	59,540
Dougherty	7,103	7,113	7,112	7,120	7,125	7,130	7,134	7,139	7,143	7,147	7,151
Douglas	13,704	13,736	13,774	13,788	13,817	13,845	13,873	13,899	13,925	13,951	13,975
Fulton	87,833	88,018	88,208	88,394	88,650	88,901	89,153	89,396	89,633	89,880	90,119
Gwinnett	93,839	94,044	94,189	94,313	94,482	94,644	94,801	94,956	95,108	95,252	95,392
Hall	25,753	25,787	25,822	25,844	25,870	25,896	25,921	25,944	25,966	25,988	26,010
Henry	22,502	22,549	22,597	22,641	22,726	22,811	22,897	22,977	23,058	23,140	23,218
Lee	2,614	2,617	2,622	2,625	2,629	2,633	2,636	2,640	2,643	2,647	2,650

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:		
	3/8	3/9	3/10	3/11	3/13	3/15	3/17
Bartow	13,257	13,288	13,323	13,361	13,414 (2,683) [644] {322}	13,463 (2,693) [646] {323}	13,507 (2,701) [648] {324}
Carroll	10,650	10,660	10,669	10,686	10,704 (2,141) [514] {257}	10,720 (2,144) [515] {257}	10,735 (2,147) [515] {258}
Cherokee	27,956	28,042	28,116	28,184	28,301 (5,660) [1,358] {679}	28,414 (5,683) [1,364] {682}	28,518 (5,704) [1,369] {684}
Clarke	14,289	14,306	14,339	14,365	14,407 (2,881) [692] {346}	14,447 (2,889) [693] {347}	14,485 (2,897) [695] {348}
Clayton	23,706	23,757	23,822	23,874	23,972 (4,794) [1,151] {575}	24,063 (4,813) [1,155] {578}	24,151 (4,830) [1,159] {580}
Cobb	70,920	71,071	71,190	71,304	71,582 (14,316) [3,436] {1,718}	71,846 (14,369) [3,449] {1,724}	72,090 (14,418) [3,460] {1,730}
DeKalb	58,234	58,357	58,493	58,629	58,901 (11,780) [2,827] {1,414}	59,163 (11,833) [2,840] {1,420}	59,417 (11,883) [2,852] {1,426}
Dougherty	7,103	7,113	7,112	7,120	7,130 (1,426) [342] {171}	7,139 (1,428) [343] {171}	7,147 (1,429) [343] {172}
Douglas	13,704	13,736	13,774	13,788	13,845 (2,769) [665] {332}	13,899 (2,780) [667] {334}	13,951 (2,790) [670] {335}
Fulton	87,833	88,018	88,208	88,394	88,901 (17,780) [4,267] {2,134}	89,396 (17,879) [4,291] {2,145}	89,880 (17,976) [4,314] {2,157}
Gwinnett	93,839	94,044	94,189	94,313	94,644 (18,929) [4,543] {2,271}	94,956 (18,991) [4,558] {2,279}	95,252 (19,050) [4,572] {2,286}
Hall	25,753	25,787	25,822	25,844	25,896 (5,179) [1,243] {622}	25,944 (5,189) [1,245] {623}	25,988 (5,198) [1,247] {624}
Henry	22,502	22,549	22,597	22,641	22,811 (4,562) [1,095] {547}	22,977 (4,595) [1,103] {551}	23,140 (4,628) [1,111] {555}
Lee	2,614	2,617	2,622	2,625	2,633 (527) [126] {63}	2,640 (528) [127] {63}	2,647 (529) [127] {64}

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.