IEM's AI Modeling: Short-term COVID-19 Projections
Date: 3/31/21

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 3/31/21 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
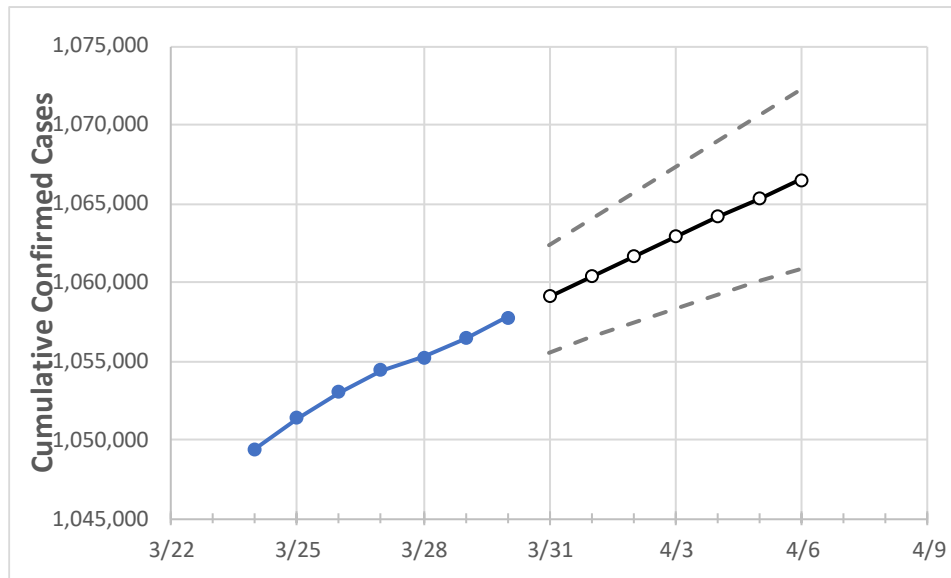
	Actual Confirmed Cases On:				Projected Cases For:						
	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	4/6
Georgia	1,054,430	1,055,256	1,056,421	1,057,741	1,059,064	1,060,357	1,061,632	1,062,902	1,064,134	1,065,318	1,066,515

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:						
	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	4/6
Bartow	13,844	13,855	13,866	13,898	13,922	13,947	13,971	13,995	14,019	14,041	14,063
Carroll	10,883	10,889	10,902	10,917	10,932	10,946	10,960	10,976	10,991	11,007	11,022
Cherokee	29,277	29,316	29,365	29,405	29,472	29,539	29,605	29,669	29,734	29,798	29,861
Clarke	14,564	14,571	14,575	14,580	14,590	14,599	14,609	14,618	14,627	14,636	14,645
Clayton	24,616	24,647	24,677	24,709	24,752	24,795	24,837	24,879	24,921	24,964	25,006
Cobb	73,482	73,568	73,698	73,832	73,968	74,103	74,242	74,377	74,513	74,648	74,782
DeKalb	60,835	60,899	61,080	61,197	61,340	61,483	61,627	61,770	61,911	62,051	62,194
Dougherty	7,217	7,221	7,224	7,231	7,237	7,243	7,250	7,256	7,262	7,268	7,275
Douglas	14,173	14,194	14,219	14,241	14,266	14,292	14,317	14,343	14,368	14,394	14,419
Fulton	91,185	91,302	91,428	91,533	91,691	91,843	91,992	92,142	92,287	92,433	92,576
Gwinnett	96,379	96,486	96,586	96,701	96,818	96,936	97,052	97,167	97,280	97,395	97,506
Hall	26,248	26,271	26,283	26,309	26,333	26,357	26,380	26,405	26,427	26,450	26,475
Henry	23,536	23,561	23,604	23,625	23,658	23,690	23,722	23,752	23,781	23,807	23,835
Lee	2,662	2,662	2,663	2,663	2,665	2,666	2,667	2,669	2,670	2,672	2,673

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:		
	3/27	3/28	3/29	3/30	4/1	4/3	4/5
Bartow	13,844	13,855	13,866	13,898	13,947 (2,789) [669] {335}	13,995 (2,799) [672] {336}	14,041 (2,808) [674] {337}
Carroll	10,883	10,889	10,902	10,917	10,946 (2,189) [525] {263}	10,976 (2,195) [527] {263}	11,007 (2,201) [528] {264}
Cherokee	29,277	29,316	29,365	29,405	29,539 (5,908) [1,418] {709}	29,669 (5,934) [1,424] {712}	29,798 (5,960) [1,430] {715}
Clarke	14,564	14,571	14,575	14,580	14,599 (2,920) [701] {350}	14,618 (2,924) [702] {351}	14,636 (2,927) [703] {351}
Clayton	24,616	24,647	24,677	24,709	24,795 (4,959) [1,190] {595}	24,879 (4,976) [1,194] {597}	24,964 (4,993) [1,198] {599}
Cobb	73,482	73,568	73,698	73,832	74,103 (14,821) [3,557] {1,778}	74,377 (14,875) [3,570] {1,785}	74,648 (14,930) [3,583] {1,792}
DeKalb	60,835	60,899	61,080	61,197	61,483 (12,297) [2,951] {1,476}	61,770 (12,354) [2,965] {1,482}	62,051 (12,410) [2,978] {1,489}
Dougherty	7,217	7,221	7,224	7,231	7,243 (1,449) [348] {174}	7,256 (1,451) [348] {174}	7,268 (1,454) [349] {174}
Douglas	14,173	14,194	14,219	14,241	14,292 (2,858) [686] {343}	14,343 (2,869) [688] {344}	14,394 (2,879) [691] {345}
Fulton	91,185	91,302	91,428	91,533	91,843 (18,369) [4,408] {2,204}	92,142 (18,428) [4,423] {2,211}	92,433 (18,487) [4,437] {2,218}
Gwinnett	96,379	96,486	96,586	96,701	96,936 (19,387) [4,653] {2,326}	97,167 (19,433) [4,664] {2,332}	97,395 (19,479) [4,675] {2,337}
Hall	26,248	26,271	26,283	26,309	26,357 (5,271) [1,265] {633}	26,405 (5,281) [1,267] {634}	26,450 (5,290) [1,270] {635}
Henry	23,536	23,561	23,604	23,625	23,690 (4,738) [1,137] {569}	23,752 (4,750) [1,140] {570}	23,807 (4,761) [1,143] {571}
Lee	2,662	2,662	2,663	2,663	2,666 (533) [128] {64}	2,669 (534) [128] {64}	2,672 (534) [128] {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.