IEM's AI Modeling: Short-term COVID-19 Projections
Date: 2/23/21

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 2/23/21 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
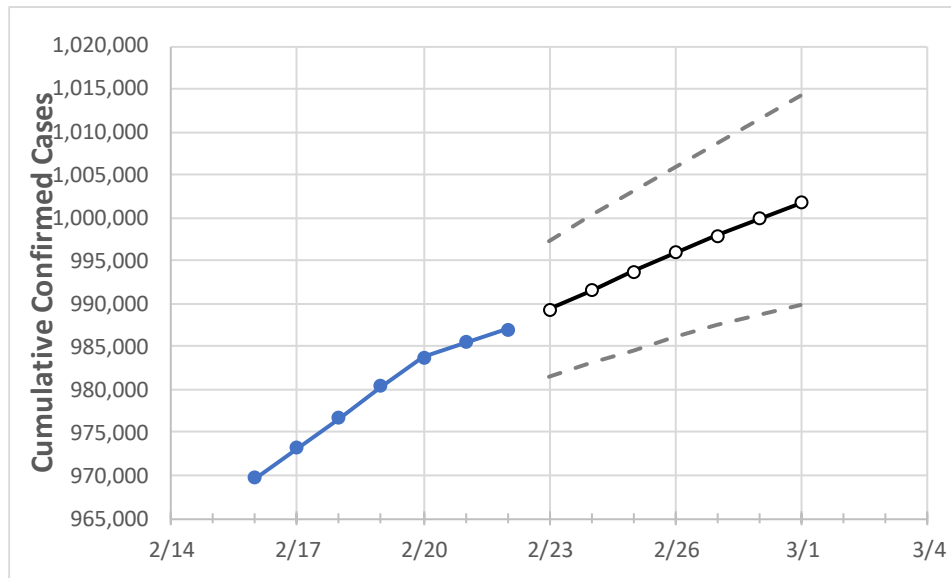
	Actual Confirmed Cases On:				Projected Cases For:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Georgia	980,411	983,747	985,505	987,041	989,352	991,559	993,764	995,890	997,872	999,857	1,001,750

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Bartow	12,476	12,546	12,577	12,611	12,659	12,707	12,754	12,800	12,845	12,888	12,932
Carroll	10,317	10,332	10,358	10,383	10,403	10,422	10,440	10,458	10,475	10,490	10,505
Cherokee	26,342	26,446	26,494	26,592	26,676	26,759	26,839	26,919	26,998	27,073	27,145
Clarke	13,869	13,891	13,905	13,914	13,935	13,956	13,974	13,993	14,010	14,025	14,041
Clayton	22,463	22,558	22,605	22,644	22,703	22,760	22,815	22,868	22,918	22,966	23,014
Cobb	67,772	67,977	68,087	68,282	68,451	68,612	68,773	68,923	69,066	69,209	69,340
DeKalb	55,306	55,504	55,659	55,772	55,919	56,057	56,188	56,318	56,444	56,564	56,684
Dougherty	6,968	6,970	6,978	6,983	6,991	6,998	7,005	7,011	7,017	7,023	7,029
Douglas	13,027	13,084	13,113	13,149	13,189	13,227	13,264	13,299	13,333	13,365	13,396
Fulton	83,059	83,346	83,547	83,698	83,891	84,081	84,262	84,435	84,601	84,765	84,928
Gwinnett	89,853	90,142	90,299	90,437	90,627	90,811	90,983	91,148	91,309	91,463	91,611
Hall	25,087	25,129	25,153	25,180	25,212	25,243	25,272	25,301	25,327	25,352	25,377
Henry	20,836	20,918	20,952	20,993	21,047	21,099	21,149	21,195	21,241	21,285	21,328
Lee	2,534	2,537	2,538	2,539	2,542	2,544	2,547	2,549	2,551	2,553	2,555

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:		
	2/19	2/20	2/21	2/22	2/24	2/26	2/28
Bartow	12,476	12,546	12,577	12,611	12,707 (2,541) [610] {305}	12,800 (2,560) [614] {307}	12,888 (2,578) [619] {309}
Carroll	10,317	10,332	10,358	10,383	10,422 (2,084) [500] {250}	10,458 (2,092) [502] {251}	10,490 (2,098) [504] {252}
Cherokee	26,342	26,446	26,494	26,592	26,759 (5,352) [1,284] {642}	26,919 (5,384) [1,292] {646}	27,073 (5,415) [1,300] {650}
Clarke	13,869	13,891	13,905	13,914	13,956 (2,791) [670] {335}	13,993 (2,799) [672] {336}	14,025 (2,805) [673] {337}
Clayton	22,463	22,558	22,605	22,644	22,760 (4,552) [1,092] {546}	22,868 (4,574) [1,098] {549}	22,966 (4,593) [1,102] {551}
Cobb	67,772	67,977	68,087	68,282	68,612 (13,722) [3,293] {1,647}	68,923 (13,785) [3,308] {1,654}	69,209 (13,842) [3,322] {1,661}
DeKalb	55,306	55,504	55,659	55,772	56,057 (11,211) [2,691] {1,345}	56,318 (11,264) [2,703] {1,352}	56,564 (11,313) [2,715] {1,358}
Dougherty	6,968	6,970	6,978	6,983	6,998 (1,400) [336] {168}	7,011 (1,402) [337] {168}	7,023 (1,405) [337] {169}
Douglas	13,027	13,084	13,113	13,149	13,227 (2,645) [635] {317}	13,299 (2,660) [638] {319}	13,365 (2,673) [642] {321}
Fulton	83,059	83,346	83,547	83,698	84,081 (16,816) [4,036] {2,018}	84,435 (16,887) [4,053] {2,026}	84,765 (16,953) [4,069] {2,034}
Gwinnett	89,853	90,142	90,299	90,437	90,811 (18,162) [4,359] {2,179}	91,148 (18,230) [4,375] {2,188}	91,463 (18,293) [4,390] {2,195}
Hall	25,087	25,129	25,153	25,180	25,243 (5,049) [1,212] {606}	25,301 (5,060) [1,214] {607}	25,352 (5,070) [1,217] {608}
Henry	20,836	20,918	20,952	20,993	21,099 (4,220) [1,013] {506}	21,195 (4,239) [1,017] {509}	21,285 (4,257) [1,022] {511}
Lee	2,534	2,537	2,538	2,539	2,544 (509) [122] {61}	2,549 (510) [122] {61}	2,553 (511) [123] {61}

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.