IEM's AI Modeling: Short-term COVID-19 Projections
Date: 12/16/20

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 12/16/20 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
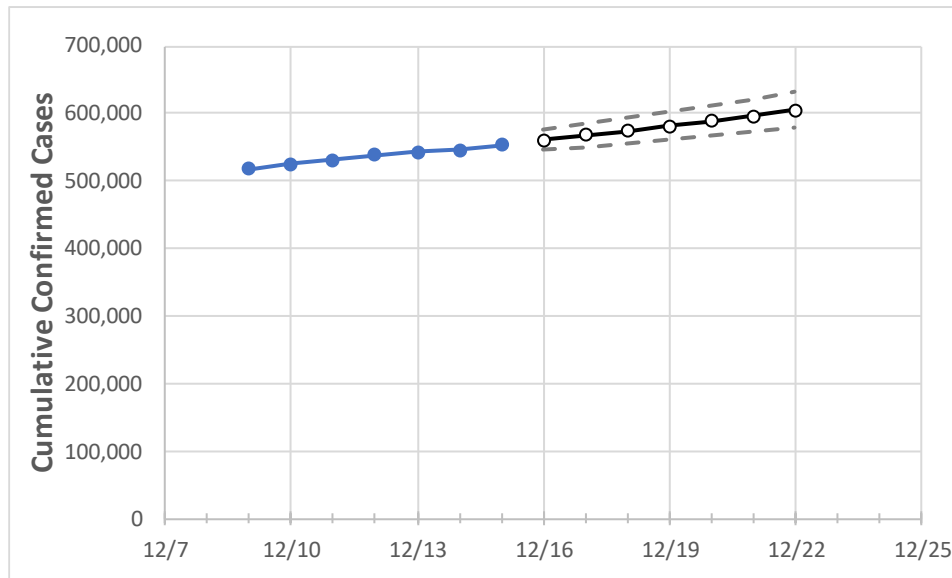
	Actual Confirmed Cases On:				Projected Cases For:						
	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22
Georgia	538,040	542,838	546,558	553,995	560,647	567,487	574,518	581,743	589,165	596,788	604,617

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 20%, and are often within 10%, of actual confirmed cases.

Georgia Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22
Bartow	6,130	6,196	6,243	6,359	6,453	6,549	6,649	6,752	6,858	6,968	7,082
Carroll	6,481	6,536	6,572	6,666	6,740	6,814	6,890	6,966	7,044	7,122	7,202
Cherokee	12,490	12,600	12,680	12,918	13,082	13,250	13,421	13,595	13,773	13,955	14,140
Clarke	8,805	8,867	8,892	8,973	9,046	9,120	9,196	9,273	9,352	9,433	9,515
Clayton	11,936	12,106	12,209	12,342	12,499	12,664	12,835	13,013	13,199	13,392	13,593
Cobb	34,687	35,101	35,427	35,876	36,350	36,838	37,340	37,858	38,391	38,939	39,503
DeKalb	31,421	31,741	31,935	32,331	32,698	33,075	33,462	33,859	34,267	34,685	35,115
Dougherty	4,143	4,167	4,185	4,204	4,242	4,282	4,324	4,367	4,412	4,460	4,509
Douglas	6,676	6,754	6,809	6,892	6,980	7,070	7,161	7,255	7,351	7,449	7,549
Fulton	46,499	46,896	47,182	47,904	48,468	49,050	49,648	50,264	50,897	51,548	52,218
Gwinnett	46,030	46,579	46,962	47,725	48,382	49,065	49,774	50,510	51,273	52,066	52,888
Hall	14,716	14,833	14,949	15,236	15,455	15,685	15,925	16,177	16,442	16,718	17,008
Henry	10,311	10,459	10,560	10,749	10,915	11,086	11,264	11,448	11,639	11,836	12,040
Lee	1,165	1,167	1,174	1,206	1,225	1,246	1,267	1,289	1,312	1,336	1,361

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:		
	12/12	12/13	12/14	12/15	12/17	12/19	12/21
Bartow	6,130	6,196	6,243	6,359	6,549 (1,310) [314] {157}	6,752 (1,350) [324] {162}	6,968 (1,394) [334] {167}
Carroll	6,481	6,536	6,572	6,666	6,814 (1,363) [327] {164}	6,966 (1,393) [334] {167}	7,122 (1,424) [342] {171}
Cherokee	12,490	12,600	12,680	12,918	13,250 (2,650) [636] {318}	13,595 (2,719) [653] {326}	13,955 (2,791) [670] {335}
Clarke	8,805	8,867	8,892	8,973	9,120 (1,824) [438] {219}	9,273 (1,855) [445] {223}	9,433 (1,887) [453] {226}
Clayton	11,936	12,106	12,209	12,342	12,664 (2,533) [608] {304}	13,013 (2,603) [625] {312}	13,392 (2,678) [643] {321}
Cobb	34,687	35,101	35,427	35,876	36,838 (7,368) [1,768] {884}	37,858 (7,572) [1,817] {909}	38,939 (7,788) [1,869] {935}
DeKalb	31,421	31,741	31,935	32,331	33,075 (6,615) [1,588] {794}	33,859 (6,772) [1,625] {813}	34,685 (6,937) [1,665] {832}
Dougherty	4,143	4,167	4,185	4,204	4,282 (856) [206] {103}	4,367 (873) [210] {105}	4,460 (892) [214] {107}
Douglas	6,676	6,754	6,809	6,892	7,070 (1,414) [339] {170}	7,255 (1,451) [348] {174}	7,449 (1,490) [358] {179}
Fulton	46,499	46,896	47,182	47,904	49,050 (9,810) [2,354] {1,177}	50,264 (10,053) [2,413] {1,206}	51,548 (10,310) [2,474] {1,237}
Gwinnett	46,030	46,579	46,962	47,725	49,065 (9,813) [2,355] {1,178}	50,510 (10,102) [2,424] {1,212}	52,066 (10,413) [2,499] {1,250}
Hall	14,716	14,833	14,949	15,236	15,685 (3,137) [753] {376}	16,177 (3,235) [777] {388}	16,718 (3,344) [802] {401}
Henry	10,311	10,459	10,560	10,749	11,086 (2,217) [532] {266}	11,448 (2,290) [550] {275}	11,836 (2,367) [568] {284}
Lee	1,165	1,167	1,174	1,206	1,246 (249) [60] {30}	1,289 (258) [62] {31}	1,336 (267) [64] {32}

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.