IEM's AI Modeling: Short-term COVID-19 Projections

Date: 8/13/20

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 not 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 20%, and are often within 10%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 8/13/20 12 p.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.

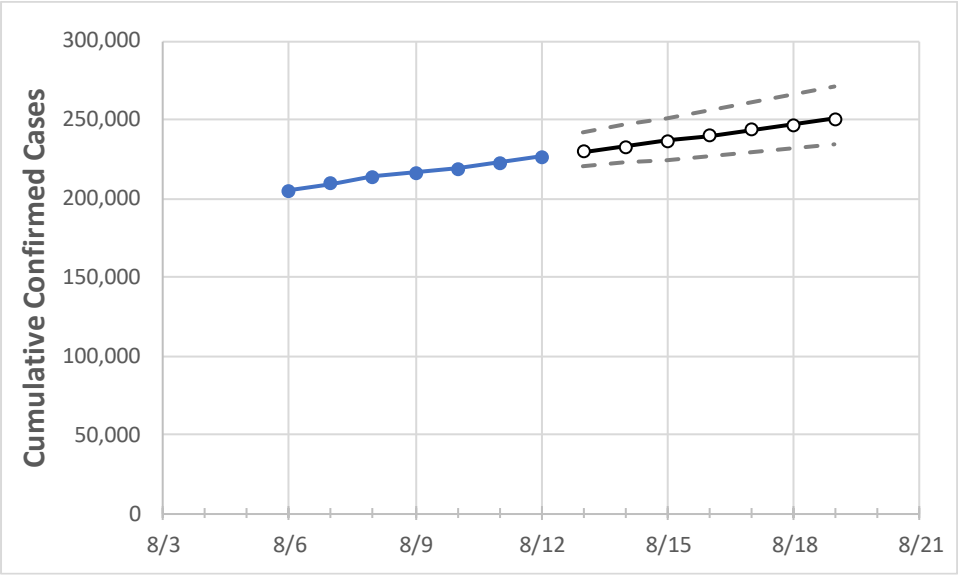
IEM's Modeling Lead

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:						
	8/9	8/10	8/11	8/12	8/13	8/14	8/15	8/16	8/17	8/18	8/19
Georgia	216,582	219,020	222,586	226,153	229,547	232,956	236,382	239,825	243,283	246,756	250,246

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:						
	8/9	8/10	8/11	8/12	8/13	8/14	8/15	8/16	8/17	8/18	8/19
Bartow	1,868	1,885	1,914	1,953	1,988	2,025	2,062	2,100	2,140	2,180	2,222
Carroll	1,881	1,894	1,905	1,910	1,922	1,934	1,945	1,956	1,968	1,979	1,989
Cherokee	3,462	3,535	3,609	3,707	3,796	3,888	3,983	4,082	4,185	4,292	4,403
Clarke	2,047	2,081	2,117	2,150	2,189	2,230	2,271	2,312	2,355	2,398	2,442
Clayton	5,006	5,059	5,154	5,245	5,311	5,377	5,443	5,510	5,578	5,646	5,714
Cobb	13,564	13,729	14,006	14,279	14,548	14,823	15,103	15,388	15,679	15,976	16,278
DeKalb	13,923	14,047	14,292	14,485	14,687	14,893	15,102	15,314	15,530	15,749	15,972
Dougherty	2,694	2,732	2,754	2,774	2,789	2,803	2,818	2,833	2,848	2,863	2,879
Douglas	2,635	2,678	2,728	2,773	2,813	2,854	2,896	2,938	2,980	3,023	3,067
Fulton	20,276	20,468	20,874	21,140	21,411	21,682	21,955	22,229	22,503	22,779	23,056
Gwinnett	19,808	19,971	20,382	20,685	20,986	21,290	21,597	21,907	22,220	22,537	22,857
Hall	6,080	6,114	6,206	6,298	6,365	6,432	6,501	6,571	6,643	6,715	6,789
Henry	3,364	3,411	3,457	3,513	3,560	3,608	3,656	3,705	3,755	3,805	3,857
Lee	539	544	551	565	570	576	581	587	593	599	605

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:		
	8/9	8/10	8/11	8/12	8/14	8/16	8/18
Bartow	1,868	1,885	1,914	1,953	2,025 (405) [97] {49}	2,100 (420) [101] {50}	2,180 (436) [105] {52}
Carroll	1,881	1,894	1,905	1,910	1,934 (387) [93] {46}	1,956 (391) [94] {47}	1,979 (396) [95] {47}
Cherokee	3,462	3,535	3,609	3,707	3,888 (778) [187] {93}	4,082 (816) [196] {98}	4,292 (858) [206] {103}
Clarke	2,047	2,081	2,117	2,150	2,230 (446) [107] {54}	2,312 (462) [111] {55}	2,398 (480) [115] {58}
Clayton	5,006	5,059	5,154	5,245	5,377 (1,075) [258] {129}	5,510 (1,102) [264] {132}	5,646 (1,129) [271] {136}
Cobb	13,564	13,729	14,006	14,279	14,823 (2,965) [712] {356}	15,388 (3,078) [739] {369}	15,976 (3,195) [767] {383}
DeKalb	13,923	14,047	14,292	14,485	14,893 (2,979) [715] {357}	15,314 (3,063) [735] {368}	15,749 (3,150) [756] {378}
Dougherty	2,694	2,732	2,754	2,774	2,803 (561) [135] {67}	2,833 (567) [136] {68}	2,863 (573) [137] {69}
Douglas	2,635	2,678	2,728	2,773	2,854 (571) [137] {69}	2,938 (588) [141] {71}	3,023 (605) [145] {73}
Fulton	20,276	20,468	20,874	21,140	21,682 (4,336) [1,041] {520}	22,229 (4,446) [1,067] {533}	22,779 (4,556) [1,093] {547}
Gwinnett	19,808	19,971	20,382	20,685	21,290 (4,258) [1,022] {511}	21,907 (4,381) [1,052] {526}	22,537 (4,507) [1,082] {541}
Hall	6,080	6,114	6,206	6,298	6,432 (1,286) [309] {154}	6,571 (1,314) [315] {158}	6,715 (1,343) [322] {161}
Henry	3,364	3,411	3,457	3,513	3,608 (722) [173] {87}	3,705 (741) [178] {89}	3,805 (761) [183] {91}
Lee	539	544	551	565	576 (115) [28] {14}	587 (117) [28] {14}	599 (120) [29] {14}

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.