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

Date: 12/28/20

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 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 12/28/20 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.

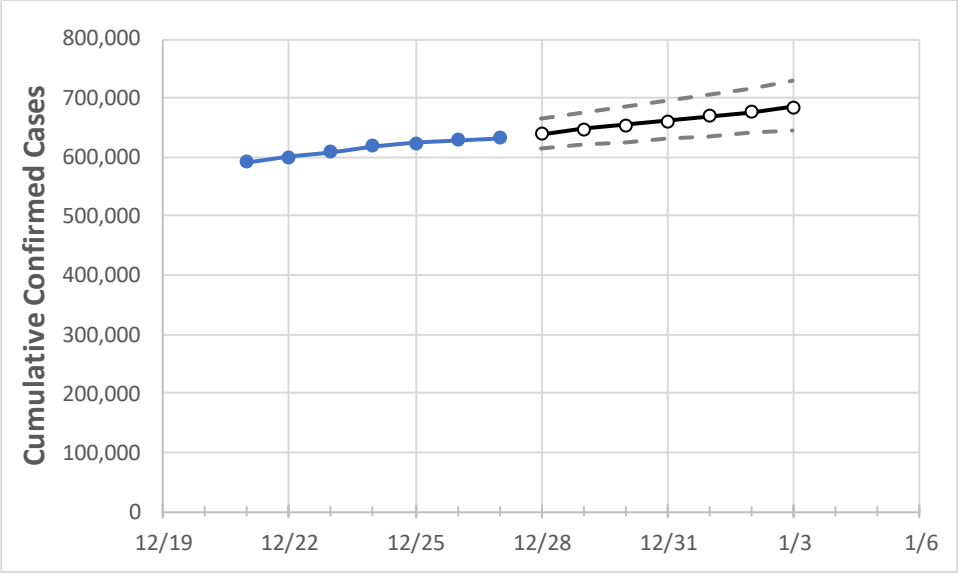
IEM's Modeling Lead

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:						
	12/24	12/25	12/26	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3
Georgia	618,576	624,630	628,788	632,299	639,686	647,002	654,238	661,944	669,471	677,109	684,992

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:						
	12/24	12/25	12/26	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3
Bartow	7,272	7,343	7,392	7,445	7,541	7,639	7,741	7,844	7,944	8,046	8,149
Carroll	7,216	7,264	7,305	7,337	7,392	7,448	7,502	7,556	7,610	7,664	7,717
Cherokee	14,825	15,025	15,178	15,310	15,532	15,766	16,000	16,239	16,484	16,727	16,980
Clarke	9,611	9,659	9,702	9,736	9,798	9,859	9,921	9,985	10,045	10,104	10,165
Clayton	13,456	13,581	13,652	13,697	13,815	13,931	14,046	14,159	14,276	14,393	14,514
Cobb	40,644	41,180	41,479	41,711	42,264	42,822	43,382	43,967	44,552	45,151	45,764
DeKalb	35,610	35,978	36,195	36,358	36,719	37,087	37,460	37,827	38,191	38,588	38,975
Dougherty	4,502	4,519	4,522	4,538	4,565	4,592	4,619	4,645	4,672	4,699	4,725
Douglas	7,714	7,767	7,854	7,896	7,983	8,069	8,158	8,247	8,336	8,425	8,518
Fulton	53,253	53,911	54,285	54,514	55,118	55,735	56,348	56,976	57,636	58,311	58,961
Gwinnett	53,261	53,692	54,074	54,368	54,965	55,568	56,176	56,795	57,408	58,054	58,706
Hall	17,264	17,361	17,467	17,582	17,794	18,005	18,222	18,445	18,670	18,901	19,140
Henry	12,248	12,392	12,494	12,579	12,743	12,907	13,070	13,238	13,404	13,570	13,738
Lee	1,369	1,376	1,383	1,393	1,408	1,424	1,440	1,456	1,473	1,490	1,506

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:		
	12/24	12/25	12/26	12/27	12/29	12/31	1/2
Bartow	7,272	7,343	7,392	7,445	7,639 (1,528) [367] {183}	7,844 (1,569) [376] {188}	8,046 (1,609) [386] {193}
Carroll	7,216	7,264	7,305	7,337	7,448 (1,490) [357] {179}	7,556 (1,511) [363] {181}	7,664 (1,533) [368] {184}
Cherokee	14,825	15,025	15,178	15,310	15,766 (3,153) [757] {378}	16,239 (3,248) [779] {390}	16,727 (3,345) [803] {401}
Clarke	9,611	9,659	9,702	9,736	9,859 (1,972) [473] {237}	9,985 (1,997) [479] {240}	10,104 (2,021) [485] {242}
Clayton	13,456	13,581	13,652	13,697	13,931 (2,786) [669] {334}	14,159 (2,832) [680] {340}	14,393 (2,879) [691] {345}
Cobb	40,644	41,180	41,479	41,711	42,822 (8,564) [2,055] {1,028}	43,967 (8,793) [2,110] {1,055}	45,151 (9,030) [2,167] {1,084}
DeKalb	35,610	35,978	36,195	36,358	37,087 (7,417) [1,780] {890}	37,827 (7,565) [1,816] {908}	38,588 (7,718) [1,852] {926}
Dougherty	4,502	4,519	4,522	4,538	4,592 (918) [220] {110}	4,645 (929) [223] {111}	4,699 (940) [226] {113}
Douglas	7,714	7,767	7,854	7,896	8,069 (1,614) [387] {194}	8,247 (1,649) [396] {198}	8,425 (1,685) [404] {202}
Fulton	53,253	53,911	54,285	54,514	55,735 (11,147) [2,675] {1,338}	56,976 (11,395) [2,735] {1,367}	58,311 (11,662) [2,799] {1,399}
Gwinnett	53,261	53,692	54,074	54,368	55,568 (11,114) [2,667] {1,334}	56,795 (11,359) [2,726] {1,363}	58,054 (11,611) [2,787] {1,393}
Hall	17,264	17,361	17,467	17,582	18,005 (3,601) [864] {432}	18,445 (3,689) [885] {443}	18,901 (3,780) [907] {454}
Henry	12,248	12,392	12,494	12,579	12,907 (2,581) [620] {310}	13,238 (2,648) [635] {318}	13,570 (2,714) [651] {326}
Lee	1,369	1,376	1,383	1,393	1,424 (285) [68] {34}	1,456 (291) [70] {35}	1,490 (298) [72] {36}

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.