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

Date: 12/1/20

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 12/1/20 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.

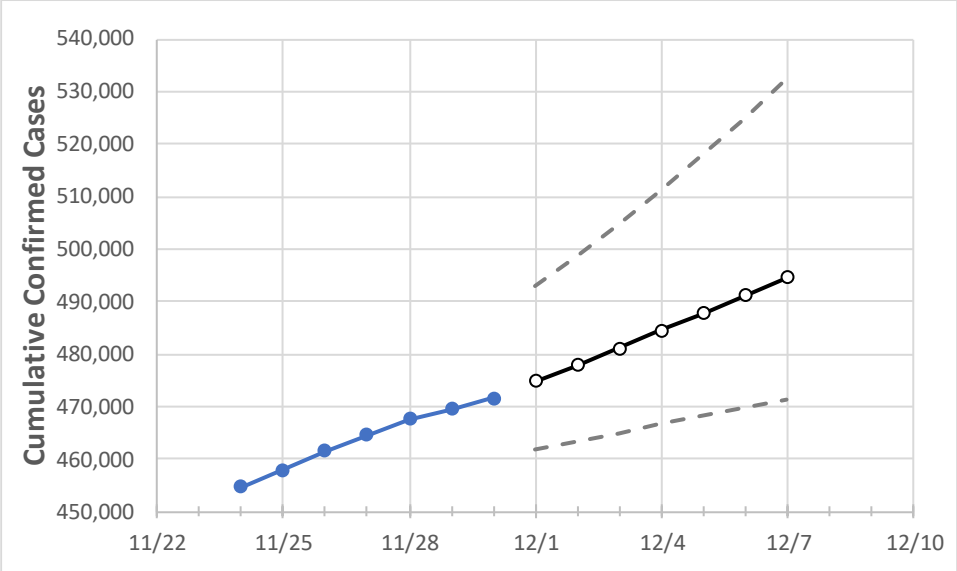
IEM's Modeling Lead

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:						
	11/27	11/28	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7
Georgia	464,526	467,564	469,516	471,563	474,720	477,914	481,147	484,419	487,730	491,081	494,473

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:						
	11/27	11/28	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7
Bartow	5,106	5,134	5,169	5,211	5,254	5,297	5,341	5,385	5,430	5,475	5,521
Carroll	5,518	5,570	5,612	5,645	5,694	5,744	5,794	5,844	5,894	5,945	5,996
Cherokee	10,454	10,572	10,616	10,680	10,764	10,848	10,933	11,018	11,104	11,190	11,276
Clarke	7,901	7,925	7,941	7,979	8,011	8,042	8,074	8,106	8,138	8,171	8,203
Clayton	10,409	10,463	10,483	10,515	10,558	10,601	10,643	10,685	10,726	10,767	10,807
Cobb	29,639	29,833	29,937	30,075	30,282	30,490	30,701	30,914	31,129	31,346	31,566
DeKalb	27,305	27,465	27,548	27,645	27,793	27,939	28,084	28,227	28,369	28,509	28,649
Dougherty	3,702	3,706	3,710	3,713	3,719	3,725	3,730	3,736	3,742	3,748	3,754
Douglas	5,663	5,682	5,703	5,722	5,761	5,799	5,839	5,878	5,918	5,958	5,999
Fulton	40,185	40,486	40,630	40,794	41,058	41,324	41,594	41,867	42,143	42,423	42,706
Gwinnett	39,249	39,510	39,694	39,906	40,173	40,444	40,720	40,999	41,282	41,569	41,860
Hall	12,560	12,635	12,678	12,759	12,836	12,915	12,996	13,080	13,167	13,256	13,347
Henry	8,623	8,687	8,716	8,758	8,822	8,887	8,953	9,020	9,088	9,156	9,226
Lee	952	954	956	959	964	969	974	980	985	991	997

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:		
	11/27	11/28	11/29	11/30	12/2	12/4	12/6
Bartow	5,106	5,134	5,169	5,211	5,297 (1,059) [254] {127}	5,385 (1,077) [258] {129}	5,475 (1,095) [263] {131}
Carroll	5,518	5,570	5,612	5,645	5,744 (1,149) [276] {138}	5,844 (1,169) [280] {140}	5,945 (1,189) [285] {143}
Cherokee	10,454	10,572	10,616	10,680	10,848 (2,170) [521] {260}	11,018 (2,204) [529] {264}	11,190 (2,238) [537] {269}
Clarke	7,901	7,925	7,941	7,979	8,042 (1,608) [386] {193}	8,106 (1,621) [389] {195}	8,171 (1,634) [392] {196}
Clayton	10,409	10,463	10,483	10,515	10,601 (2,120) [509] {254}	10,685 (2,137) [513] {256}	10,767 (2,153) [517] {258}
Cobb	29,639	29,833	29,937	30,075	30,490 (6,098) [1,464] {732}	30,914 (6,183) [1,484] {742}	31,346 (6,269) [1,505] {752}
DeKalb	27,305	27,465	27,548	27,645	27,939 (5,588) [1,341] {671}	28,227 (5,645) [1,355] {677}	28,509 (5,702) [1,368] {684}
Dougherty	3,702	3,706	3,710	3,713	3,725 (745) [179] {89}	3,736 (747) [179] {90}	3,748 (750) [180] {90}
Douglas	5,663	5,682	5,703	5,722	5,799 (1,160) [278] {139}	5,878 (1,176) [282] {141}	5,958 (1,192) [286] {143}
Fulton	40,185	40,486	40,630	40,794	41,324 (8,265) [1,984] {992}	41,867 (8,373) [2,010] {1,005}	42,423 (8,485) [2,036] {1,018}
Gwinnett	39,249	39,510	39,694	39,906	40,444 (8,089) [1,941] {971}	40,999 (8,200) [1,968] {984}	41,569 (8,314) [1,995] {998}
Hall	12,560	12,635	12,678	12,759	12,915 (2,583) [620] {310}	13,080 (2,616) [628] {314}	13,256 (2,651) [636] {318}
Henry	8,623	8,687	8,716	8,758	8,887 (1,777) [427] {213}	9,020 (1,804) [433] {216}	9,156 (1,831) [440] {220}
Lee	952	954	956	959	969 (194) [47] {23}	980 (196) [47] {24}	991 (198) [48] {24}

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.