IEM's AI Modeling: Short-term COVID-19 Projections
Date: 214/22

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 2/14/22 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
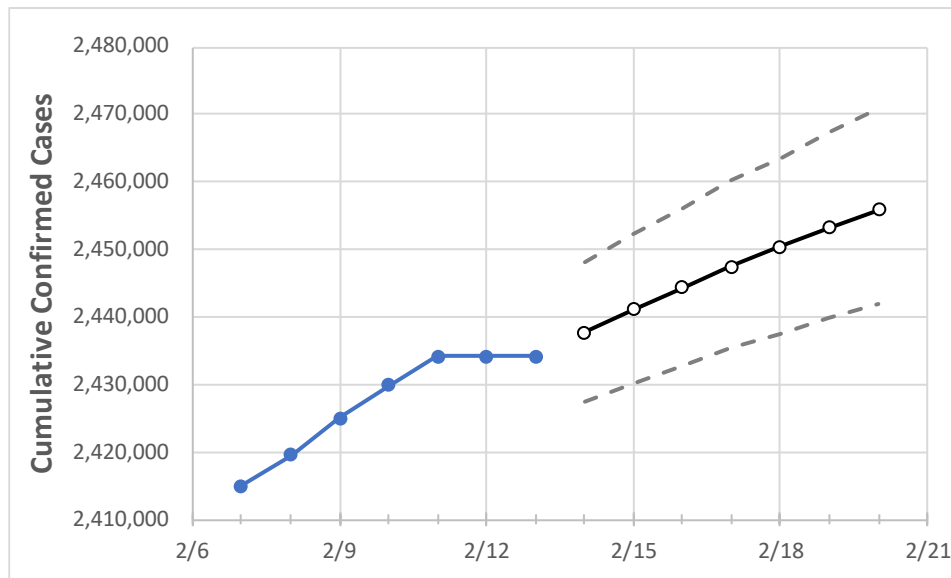
	Actual Confirmed Cases On:				Projected Cases For:						
	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20
Georgia	2,429,839	2,434,131	2,434,131	2,434,131	2,437,733	2,441,114	2,444,376	2,447,478	2,450,406	2,453,245	2,455,947

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:						
	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20
Bartow	28,087	28,126	28,126	28,126	28,151	28,174	28,195	28,216	28,235	28,254	28,271
Carroll	23,309	23,342	23,342	23,342	23,370	23,398	23,422	23,447	23,470	23,493	23,514
Cherokee	62,015	62,062	62,062	62,062	62,138	62,209	62,277	62,342	62,406	62,466	62,527
Clarke	29,209	29,236	29,236	29,236	29,265	29,290	29,315	29,338	29,360	29,381	29,401
Clayton	62,410	62,479	62,479	62,479	62,535	62,589	62,639	62,686	62,733	62,777	62,818
Cobb	166,876	167,182	167,182	167,182	167,426	167,665	167,891	168,110	168,323	168,528	168,723
DeKalb	141,867	142,121	142,121	142,121	142,331	142,527	142,709	142,887	143,053	143,236	143,383
Dougherty	19,095	19,120	19,120	19,120	19,176	19,227	19,276	19,317	19,367	19,414	19,457
Douglas	34,225	34,269	34,269	34,269	34,312	34,354	34,392	34,432	34,468	34,504	34,538
Fulton	209,177	209,514	209,514	209,514	209,784	210,047	210,310	210,556	210,780	211,037	211,235
Gwinnett	202,602	202,845	202,845	202,845	203,112	203,359	203,605	203,827	204,052	204,251	204,466
Hall	52,377	52,459	52,459	52,459	52,528	52,590	52,653	52,710	52,767	52,822	52,871
Henry	56,473	56,542	56,542	56,542	56,595	56,645	56,692	56,735	56,776	56,818	56,856
Lee	7,083	7,086	7,086	7,086	7,112	7,133	7,154	7,176	7,194	7,214	7,232

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:		
	2/10	2/11	2/12	2/13	2/15	2/17	2/19
Bartow	28,087	28,126	28,126	28,126	28,174 (5,635) [1,352] {676}	28,216 (5,643) [1,354] {677}	28,254 (5,651) [1,356] {678}
Carroll	23,309	23,342	23,342	23,342	23,398 (4,680) [1,123] {562}	23,447 (4,689) [1,125] {563}	23,493 (4,699) [1,128] {564}
Cherokee	62,015	62,062	62,062	62,062	62,209 (12,442) [2,986] {1,493}	62,342 (12,468) [2,992] {1,496}	62,466 (12,493) [2,998] {1,499}
Clarke	29,209	29,236	29,236	29,236	29,290 (5,858) [1,406] {703}	29,338 (5,868) [1,408] {704}	29,381 (5,876) [1,410] {705}
Clayton	62,410	62,479	62,479	62,479	62,589 (12,518) [3,004] {1,502}	62,686 (12,537) [3,009] {1,504}	62,777 (12,555) [3,013] {1,507}
Cobb	166,876	167,182	167,182	167,182	167,665 (33,533) [8,048] {4,024}	168,110 (33,622) [8,069] {4,035}	168,528 (33,706) [8,089] {4,045}
DeKalb	141,867	142,121	142,121	142,121	142,527 (28,505) [6,841] {3,421}	142,887 (28,577) [6,859] {3,429}	143,236 (28,647) [6,875] {3,438}
Dougherty	19,095	19,120	19,120	19,120	19,227 (3,845) [923] {461}	19,317 (3,863) [927] {464}	19,414 (3,883) [932] {466}
Douglas	34,225	34,269	34,269	34,269	34,354 (6,871) [1,649] {824}	34,432 (6,886) [1,653] {826}	34,504 (6,901) [1,656] {828}
Fulton	209,177	209,514	209,514	209,514	210,047 (42,009) [10,082] {5,041}	210,556 (42,111) [10,107] {5,053}	211,037 (42,207) [10,130] {5,065}
Gwinnett	202,602	202,845	202,845	202,845	203,359 (40,672) [9,761] {4,881}	203,827 (40,765) [9,784] {4,892}	204,251 (40,850) [9,804] {4,902}
Hall	52,377	52,459	52,459	52,459	52,590 (10,518) [2,524] {1,262}	52,710 (10,542) [2,530] {1,265}	52,822 (10,564) [2,535] {1,268}
Henry	56,473	56,542	56,542	56,542	56,645 (11,329) [2,719] {1,359}	56,735 (11,347) [2,723] {1,362}	56,818 (11,364) [2,727] {1,364}
Lee	7,083	7,086	7,086	7,086	7,133 (1,427) [342] {171}	7,176 (1,435) [344] {172}	7,214 (1,443) [346] {173}

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.