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

Date: 5/20/21

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 5/20/21 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.

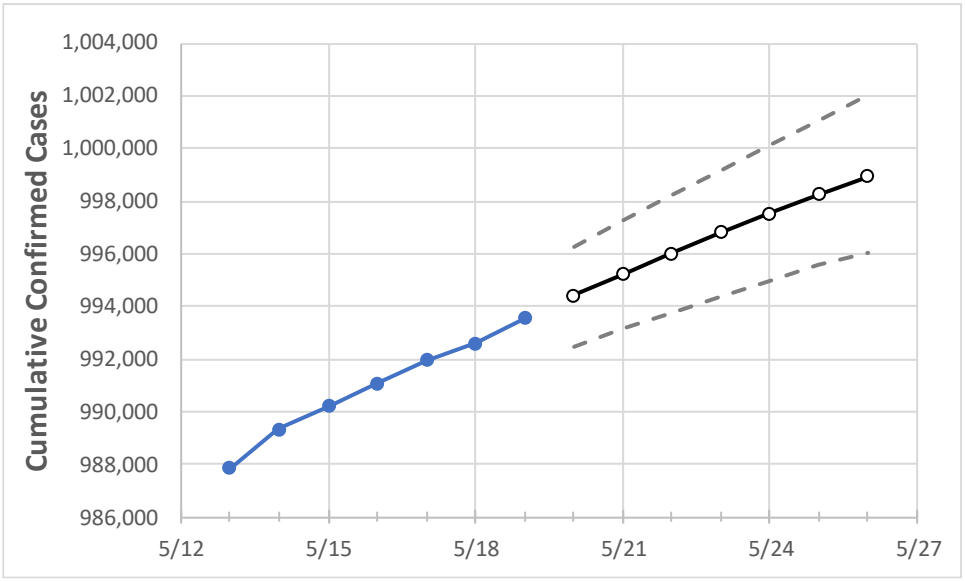
IEM's Modeling Lead

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.

North Carolina State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	5/16	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25	5/26
North Carolina	991,083	991,956	992,578	993,547	994,413	995,229	996,028	996,795	997,536	998,255	998,944

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.

North Carolina Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	5/16	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25	5/26
Cumberland	29,008	29,047	29,106	29,158	29,207	29,255	29,302	29,346	29,390	29,433	29,476
Durham	25,333	25,361	25,374	25,384	25,405	25,426	25,445	25,465	25,483	25,500	25,517
Guilford	47,692	47,744	47,783	47,830	47,894	47,957	48,018	48,079	48,142	48,205	48,266
Mecklenburg	112,291	112,376	112,429	112,524	112,610	112,692	112,769	112,844	112,915	112,981	113,045
Orange	8,547	8,550	8,549	8,548	8,551	8,553	8,556	8,558	8,560	8,562	8,564
Union	24,479	24,499	24,515	24,533	24,555	24,575	24,595	24,615	24,634	24,653	24,671
Wake	87,795	87,855	87,896	87,965	88,044	88,119	88,192	88,262	88,330	88,397	88,457

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.*

North Carolina Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	5/16	5/17	5/18	5/19	5/21	5/23	5/25
Cumberland	29,008	29,047	29,106	29,158	29,255 (5,851) [1,404] {702}	29,346 (5,869) [1,409] {704}	29,433 (5,887) [1,413] {706}
Durham	25,333	25,361	25,374	25,384	25,426 (5,085) [1,220] {610}	25,465 (5,093) [1,222] {611}	25,500 (5,100) [1,224] {612}
Guilford	47,692	47,744	47,783	47,830	47,957 (9,591) [2,302] {1,151}	48,079 (9,616) [2,308] {1,154}	48,205 (9,641) [2,314] {1,157}
Mecklenburg	112,291	112,376	112,429	112,524	112,692 (22,538) [5,409] {2,705}	112,844 (22,569) [5,417] {2,708}	112,981 (22,596) [5,423] {2,712}
Orange	8,547	8,550	8,549	8,548	8,553 (1,711) [411] {205}	8,558 (1,712) [411] {205}	8,562 (1,712) [411] {205}
Union	24,479	24,499	24,515	24,533	24,575 (4,915) [1,180] {590}	24,615 (4,923) [1,182] {591}	24,653 (4,931) [1,183] {592}
Wake	87,795	87,855	87,896	87,965	88,119 (17,624) [4,230] {2,115}	88,262 (17,652) [4,237] {2,118}	88,397 (17,679) [4,243] {2,122}

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.