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

Date: 1/5/21

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 1/5/21 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.

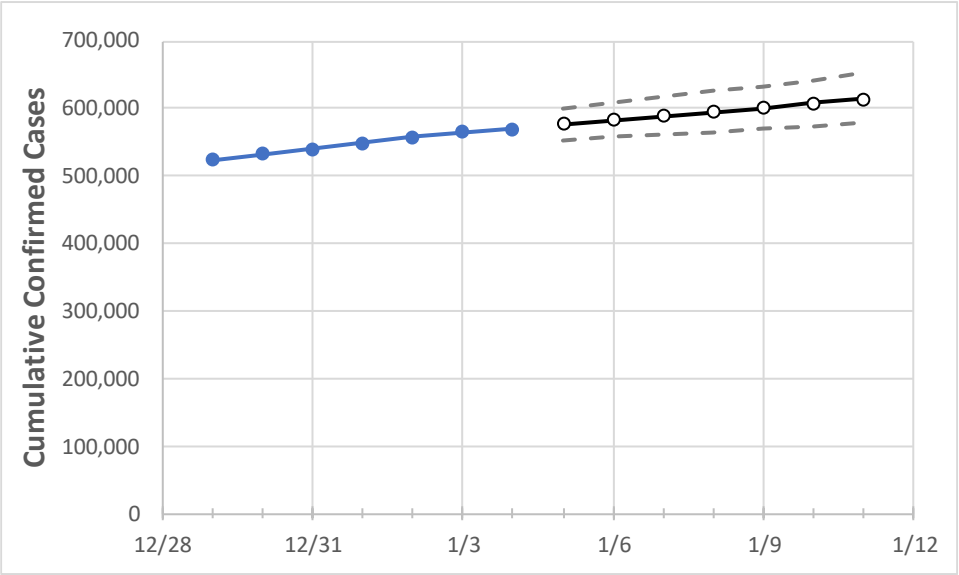
IEM's Modeling Lead

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:						
	1/1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11
North Carolina	548,991	558,437	564,924	570,111	576,391	582,521	588,749	594,952	601,355	607,446	613,871

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:						
	1/1	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11
Cumberland	14,112	14,324	14,430	14,573	14,715	14,860	15,008	15,155	15,304	15,445	15,593
Durham	14,998	15,184	15,279	15,371	15,499	15,621	15,747	15,875	16,001	16,128	16,249
Guilford	24,973	25,445	25,761	26,026	26,294	26,576	26,857	27,133	27,418	27,707	27,992
Mecklenburg	63,448	64,442	65,134	65,809	66,500	67,170	67,865	68,567	69,268	69,993	70,696
Orange	5,119	5,192	5,227	5,272	5,318	5,363	5,411	5,462	5,511	5,561	5,610
Union	12,772	13,039	13,215	13,382	13,578	13,775	13,976	14,178	14,388	14,598	14,814
Wake	44,507	44,954	45,725	46,288	46,905	47,529	48,172	48,830	49,472	50,165	50,860

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:		
	1/1	1/2	1/3	1/4	1/6	1/8	1/10
Cumberland	14,112	14,324	14,430	14,573	14,860 (2,972) [713] {357}	15,155 (3,031) [727] {364}	15,445 (3,089) [741] {371}
Durham	14,998	15,184	15,279	15,371	15,621 (3,124) [750] {375}	15,875 (3,175) [762] {381}	16,128 (3,226) [774] {387}
Guilford	24,973	25,445	25,761	26,026	26,576 (5,315) [1,276] {638}	27,133 (5,427) [1,302] {651}	27,707 (5,541) [1,330] {665}
Mecklenburg	63,448	64,442	65,134	65,809	67,170 (13,434) [3,224] {1,612}	68,567 (13,713) [3,291] {1,646}	69,993 (13,999) [3,360] {1,680}
Orange	5,119	5,192	5,227	5,272	5,363 (1,073) [257] {129}	5,462 (1,092) [262] {131}	5,561 (1,112) [267] {133}
Union	12,772	13,039	13,215	13,382	13,775 (2,755) [661] {331}	14,178 (2,836) [681] {340}	14,598 (2,920) [701] {350}
Wake	44,507	44,954	45,725	46,288	47,529 (9,506) [2,281] {1,141}	48,830 (9,766) [2,344] {1,172}	50,165 (10,033) [2,408] {1,204}

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.