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

Date: 3/25/22

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 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 3/25/22 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.

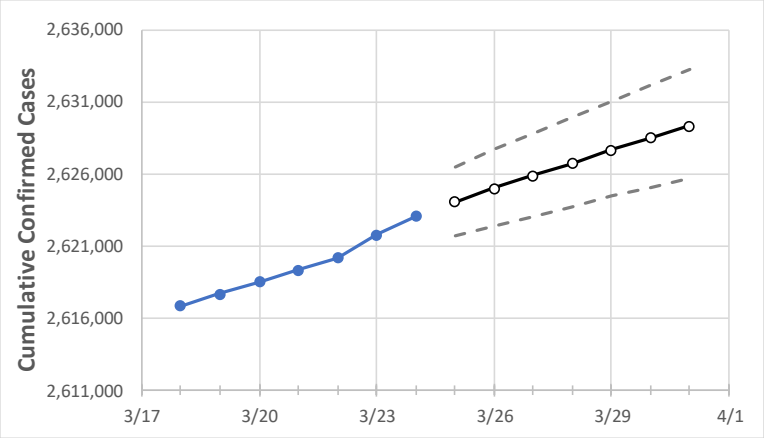
IEM's Modeling Lead

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.

North Carolina State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	3/31
North Carolina	2,619,372	2,620,191	2,621,793	2,623,081	2,624,080	2,625,020	2,625,898	2,626,768	2,627,681	2,628,547	2,629,366

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:						
	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	3/31
Cumberland	83,081	83,193	83,341	83,506	83,591	83,675	83,764	83,854	83,938	84,031	84,119
Durham	70,070	70,091	70,160	70,212	70,252	70,292	70,330	70,368	70,408	70,446	70,484
Guilford	115,952	115,979	116,035	116,127	116,175	116,215	116,257	116,297	116,339	116,385	116,420
Mecklenburg	276,960	277,020	277,142	277,210	277,293	277,372	277,450	277,526	277,603	277,682	277,757
Orange	25,889	25,915	25,945	25,956	25,977	25,997	26,017	26,037	26,057	26,077	26,098
Union	61,356	61,363	61,405	61,428	61,440	61,450	61,460	61,469	61,478	61,489	61,496
Wake	289,068	289,145	289,373	289,543	289,656	289,766	289,868	289,973	290,074	290,172	290,269

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:											
	3/21	3/22	3/23	3/24	3/26				3/28				3/30			
Cumberland	83,081	83,193	83,341	83,506	83,675	(16,735)	[4,016]	{2,008}	83,854	(16,771)	[4,025]	{2,012}	84,031	(16,806)	[4,034]	{2,017}
Durham	70,070	70,091	70,160	70,212	70,292	(14,058)	[3,374]	{1,687}	70,368	(14,074)	[3,378]	{1,689}	70,446	(14,089)	[3,381]	{1,691}
Guilford	115,952	115,979	116,035	116,127	116,215	(23,243)	[5,578]	{2,789}	116,297	(23,259)	[5,582]	{2,791}	116,385	(23,277)	[5,586]	{2,793}
Mecklenburg	276,960	277,020	277,142	277,210	277,372	(55,474)	[13,314]	{6,657}	277,526	(55,505)	[13,321]	{6,661}	277,682	(55,536)	[13,329]	{6,664}
Orange	25,889	25,915	25,945	25,956	25,997	(5,199)	[1,248]	{624}	26,037	(5,207)	[1,250]	{625}	26,077	(5,215)	[1,252]	{626}
Union	61,356	61,363	61,405	61,428	61,450	(12,290)	[2,950]	{1,475}	61,469	(12,294)	[2,951]	{1,475}	61,489	(12,298)	[2,951]	{1,476}
Wake	289,068	289,145	289,373	289,543	289,766	(57,953)	[13,909]	{6,954}	289,973	(57,995)	[13,919]	{6,959}	290,172	(58,034)	[13,928]	{6,964}

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.