

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

Date: 3/5/21

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 3/5/21 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.

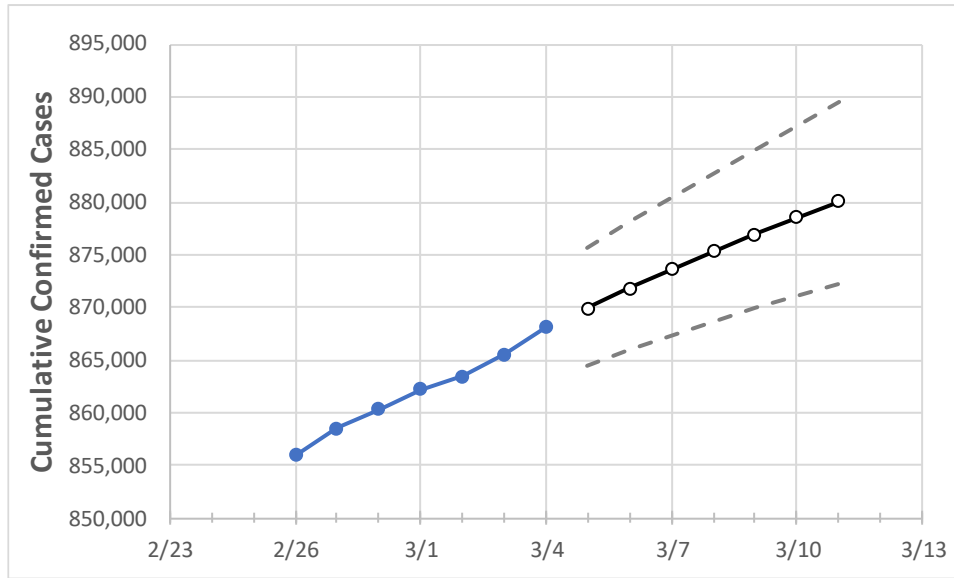
IEM's Modeling Lead

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:						
	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11
North Carolina	862,170	863,409	865,554	868,056	869,935	871,774	873,592	875,320	876,958	878,543	880,080

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:						
	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11
Cumberland	24,150	24,190	24,267	24,324	24,384	24,441	24,493	24,547	24,596	24,644	24,693
Durham	21,557	21,585	21,612	21,673	21,709	21,744	21,777	21,809	21,840	21,870	21,897
Guilford	39,936	40,024	40,105	40,228	40,310	40,389	40,467	40,541	40,615	40,686	40,754
Mecklenburg	97,073	97,203	97,409	97,600	97,800	97,989	98,177	98,360	98,537	98,709	98,867
Orange	7,743	7,753	7,767	7,793	7,808	7,822	7,835	7,849	7,862	7,875	7,887
Union	20,743	20,784	20,846	20,928	20,981	21,033	21,082	21,131	21,179	21,225	21,271
Wake	74,599	74,696	74,957	75,183	75,345	75,496	75,650	75,793	75,938	76,075	76,213

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:											
	3/1	3/2	3/3	3/4	3/6			3/8			3/10					
Cumberland	24,150	24,190	24,267	24,324	24,441	(4,888)	[1,173]	{587}	24,547	(4,909)	[1,178]	{589}	24,644	(4,929)	[1,183]	{591}
Durham	21,557	21,585	21,612	21,673	21,744	(4,349)	[1,044]	{522}	21,809	(4,362)	[1,047]	{523}	21,870	(4,374)	[1,050]	{525}
Guilford	39,936	40,024	40,105	40,228	40,389	(8,078)	[1,939]	{969}	40,541	(8,108)	[1,946]	{973}	40,686	(8,137)	[1,953]	{976}
Mecklenburg	97,073	97,203	97,409	97,600	97,989	(19,598)	[4,703]	{2,352}	98,360	(19,672)	[4,721]	{2,361}	98,709	(19,742)	[4,738]	{2,369}
Orange	7,743	7,753	7,767	7,793	7,822	(1,564)	[375]	{188}	7,849	(1,570)	[377]	{188}	7,875	(1,575)	[378]	{189}
Union	20,743	20,784	20,846	20,928	21,033	(4,207)	[1,010]	{505}	21,131	(4,226)	[1,014]	{507}	21,225	(4,245)	[1,019]	{509}
Wake	74,599	74,696	74,957	75,183	75,496	(15,099)	[3,624]	{1,812}	75,793	(15,159)	[3,638]	{1,819}	76,075	(15,215)	[3,652]	{1,826}

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.