

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

Date: 3/3/21

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 3/3/21 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.

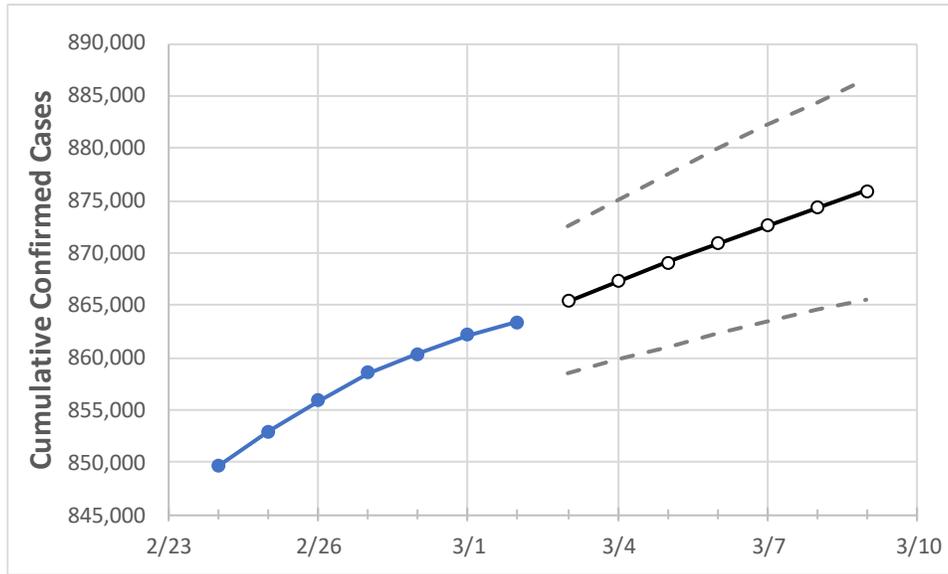
IEM's Modeling Lead

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:					
	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	
North Carolina	858,548	860,359	862,170	863,409	865,396	867,304	869,116	870,913	872,620	874,314	875,944	

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:							
	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	
Cumberland	24,067	24,109	24,150	24,190	24,252	24,313	24,372	24,428	24,484	24,536	24,586	
Durham	21,491	21,524	21,557	21,585	21,622	21,659	21,693	21,725	21,758	21,789	21,818	
Guilford	39,769	39,853	39,936	40,024	40,107	40,186	40,263	40,340	40,410	40,478	40,548	
Mecklenburg	96,552	96,813	97,073	97,203	97,416	97,625	97,824	98,020	98,213	98,399	98,579	
Orange	7,702	7,723	7,743	7,753	7,769	7,784	7,799	7,814	7,828	7,841	7,855	
Union	20,652	20,698	20,743	20,784	20,834	20,884	20,933	20,981	21,026	21,069	21,112	
Wake	74,250	74,425	74,599	74,696	74,852	75,000	75,141	75,279	75,412	75,535	75,661	

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:											
	2/27	2/28	3/1	3/2	3/4				3/6				3/8			
Cumberland	24,067	24,109	24,150	24,190	24,313	(4,863)	[1,167]	{584}	24,428	(4,886)	[1,173]	{586}	24,536	(4,907)	[1,178]	{589}
Durham	21,491	21,524	21,557	21,585	21,659	(4,332)	[1,040]	{520}	21,725	(4,345)	[1,043]	{521}	21,789	(4,358)	[1,046]	{523}
Guilford	39,769	39,853	39,936	40,024	40,186	(8,037)	[1,929]	{964}	40,340	(8,068)	[1,936]	{968}	40,478	(8,096)	[1,943]	{971}
Mecklenburg	96,552	96,813	97,073	97,203	97,625	(19,525)	[4,686]	{2,343}	98,020	(19,604)	[4,705]	{2,352}	98,399	(19,680)	[4,723]	{2,362}
Orange	7,702	7,723	7,743	7,753	7,784	(1,557)	[374]	{187}	7,814	(1,563)	[375]	{188}	7,841	(1,568)	[376]	{188}
Union	20,652	20,698	20,743	20,784	20,884	(4,177)	[1,002]	{501}	20,981	(4,196)	[1,007]	{504}	21,069	(4,214)	[1,011]	{506}
Wake	74,250	74,425	74,599	74,696	75,000	(15,000)	[3,600]	{1,800}	75,279	(15,056)	[3,613]	{1,807}	75,535	(15,107)	[3,626]	{1,813}

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.