

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 12/10/21**

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 12/10/21 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.

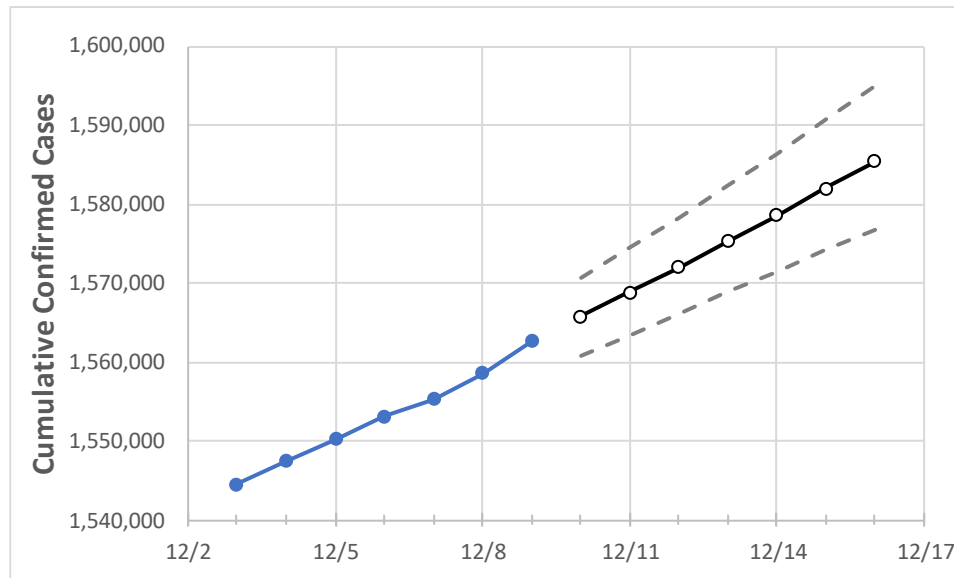
IEM's Modeling Lead

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:							
	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14	12/15	12/16	
North Carolina	1,553,112	1,555,216	1,558,510	1,562,663	1,565,741	1,568,833	1,572,029	1,575,290	1,578,633	1,581,977	1,585,390	

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:							
	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14	12/15	12/16	
Cumberland	48,285	48,345	48,469	48,618	48,716	48,817	48,919	49,025	49,130	49,238	49,350	
Durham	36,269	36,322	36,396	36,471	36,535	36,600	36,666	36,734	36,804	36,875	36,948	
Guilford	71,476	71,601	71,726	71,892	72,025	72,160	72,295	72,437	72,580	72,725	72,876	
Mecklenburg	164,294	164,502	164,808	165,159	165,449	165,752	166,056	166,369	166,688	167,018	167,343	
Orange	12,424	12,437	12,473	12,493	12,517	12,541	12,565	12,590	12,616	12,642	12,668	
Union	38,646	38,720	38,810	38,911	38,999	39,081	39,170	39,259	39,348	39,441	39,534	
Wake	136,320	136,441	136,639	137,145	137,426	137,706	137,993	138,281	138,587	138,895	139,207	

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:											
	12/6	12/7	12/8	12/9	12/11				12/13				12/15			
Cumberland	48,285	48,345	48,469	48,618	48,817	(9,763)	[2,343]	{1,172}	49,025	(9,805)	[2,353]	{1,177}	49,238	(9,848)	[2,363]	{1,182}
Durham	36,269	36,322	36,396	36,471	36,600	(7,320)	[1,757]	{878}	36,734	(7,347)	[1,763]	{882}	36,875	(7,375)	[1,770]	{885}
Guilford	71,476	71,601	71,726	71,892	72,160	(14,432)	[3,464]	{1,732}	72,437	(14,487)	[3,477]	{1,738}	72,725	(14,545)	[3,491]	{1,745}
Mecklenburg	164,294	164,502	164,808	165,159	165,752	(33,150)	[7,956]	{3,978}	166,369	(33,274)	[7,986]	{3,993}	167,018	(33,404)	[8,017]	{4,008}
Orange	12,424	12,437	12,473	12,493	12,541	(2,508)	[602]	{301}	12,590	(2,518)	[604]	{302}	12,642	(2,528)	[607]	{303}
Union	38,646	38,720	38,810	38,911	39,081	(7,816)	[1,876]	{938}	39,259	(7,852)	[1,884]	{942}	39,441	(7,888)	[1,893]	{947}
Wake	136,320	136,441	136,639	137,145	137,706	(27,541)	[6,610]	{3,305}	138,281	(27,656)	[6,637]	{3,319}	138,895	(27,779)	[6,667]	{3,333}

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.