

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

Date: 12/29/20

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 12/29/20 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.

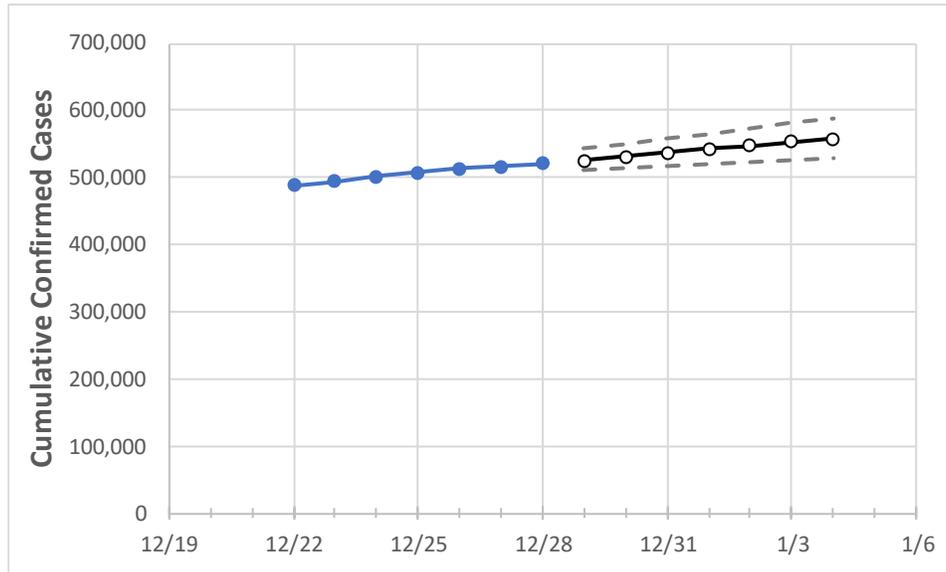
IEM's Modeling Lead

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:							
	12/25	12/26	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3	1/4	
North Carolina	507,457	513,930	516,828	520,716	526,028	531,454	536,843	542,338	547,652	552,891	558,181	

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 20%, and are often within 10%, of actual confirmed cases.

North Carolina Counties

	Actual Confirmed Cases On:				Projected Cases For:							
	12/25	12/26	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3	1/4	
Cumberland	13,146	13,290	13,343	13,435	13,560	13,690	13,820	13,946	14,070	14,192	14,310	
Durham	14,157	14,276	14,326	14,376	14,478	14,580	14,680	14,781	14,883	14,980	15,075	
Guilford	23,215	23,482	23,628	23,810	24,043	24,265	24,490	24,714	24,935	25,157	25,370	
Mecklenburg	59,054	59,704	60,144	60,618	61,222	61,810	62,387	62,968	63,552	64,124	64,693	
Orange	4,834	4,882	4,891	4,932	4,963	4,994	5,025	5,055	5,085	5,116	5,146	
Union	11,484	11,653	11,786	11,910	12,065	12,220	12,375	12,529	12,685	12,840	12,995	
Wake	40,399	40,855	41,118	41,823	42,267	42,701	43,140	43,586	44,018	44,441	44,871	

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:											
	12/25	12/26	12/27	12/28	12/30				1/1				1/3			
Cumberland	13,146	13,290	13,343	13,435	13,690	(2,738)	[657]	{329}	13,946	(2,789)	[669]	{335}	14,192	(2,838)	[681]	{341}
Durham	14,157	14,276	14,326	14,376	14,580	(2,916)	[700]	{350}	14,781	(2,956)	[710]	{355}	14,980	(2,996)	[719]	{360}
Guilford	23,215	23,482	23,628	23,810	24,265	(4,853)	[1,165]	{582}	24,714	(4,943)	[1,186]	{593}	25,157	(5,031)	[1,208]	{604}
Mecklenburg	59,054	59,704	60,144	60,618	61,810	(12,362)	[2,967]	{1,483}	62,968	(12,594)	[3,022]	{1,511}	64,124	(12,825)	[3,078]	{1,539}
Orange	4,834	4,882	4,891	4,932	4,994	(999)	[240]	{120}	5,055	(1,011)	[243]	{121}	5,116	(1,023)	[246]	{123}
Union	11,484	11,653	11,786	11,910	12,220	(2,444)	[587]	{293}	12,529	(2,506)	[601]	{301}	12,840	(2,568)	[616]	{308}
Wake	40,399	40,855	41,118	41,823	42,701	(8,540)	[2,050]	{1,025}	43,586	(8,717)	[2,092]	{1,046}	44,441	(8,888)	[2,133]	{1,067}

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.