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

Date: 3/15/22

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 3/15/22 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.

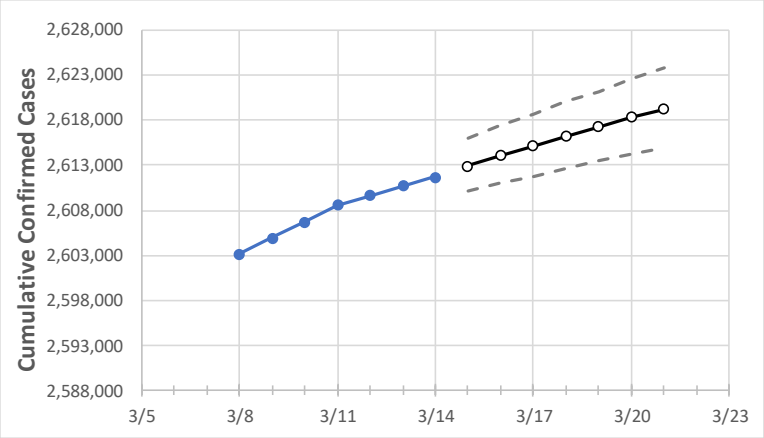
IEM's Modeling Lead

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:						
	3/11	3/12	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21
North Carolina	2,608,603	2,609,646	2,610,690	2,611,733	2,612,949	2,614,118	2,615,169	2,616,257	2,617,260	2,618,302	2,619,228

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:						
	3/11	3/12	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21
Cumberland	82,477	82,536	82,594	82,653	82,722	82,790	82,861	82,928	82,991	83,061	83,128
Durham	69,647	69,689	69,732	69,774	69,820	69,861	69,907	69,947	69,987	70,028	70,067
Guilford	115,467	115,526	115,586	115,645	115,702	115,750	115,800	115,841	115,887	115,935	115,979
Mecklenburg	276,029	276,121	276,212	276,304	276,376	276,453	276,523	276,590	276,654	276,719	276,775
Orange	25,687	25,697	25,708	25,718	25,735	25,751	25,766	25,781	25,795	25,810	25,823
Union	61,339	61,358	61,378	61,397	61,414	61,432	61,449	61,464	61,480	61,495	61,509
Wake	287,831	287,954	288,076	288,199	288,349	288,488	288,626	288,756	288,895	289,018	289,137

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:											
	3/11	3/12	3/13	3/14	3/16				3/18				3/20			
Cumberland	82,477	82,536	82,594	82,653	82,790	(16,558)	[3,974]	{1,987}	82,928	(16,586)	[3,981]	{1,990}	83,061	(16,612)	[3,987]	{1,993}
Durham	69,647	69,689	69,732	69,774	69,861	(13,972)	[3,353]	{1,677}	69,947	(13,989)	[3,357]	{1,679}	70,028	(14,006)	[3,361]	{1,681}
Guilford	115,467	115,526	115,586	115,645	115,750	(23,150)	[5,556]	{2,778}	115,841	(23,168)	[5,560]	{2,780}	115,935	(23,187)	[5,565]	{2,782}
Mecklenburg	276,029	276,121	276,212	276,304	276,453	(55,291)	[13,270]	{6,635}	276,590	(55,318)	[13,276]	{6,638}	276,719	(55,344)	[13,282]	{6,641}
Orange	25,687	25,697	25,708	25,718	25,751	(5,150)	[1,236]	{618}	25,781	(5,156)	[1,237]	{619}	25,810	(5,162)	[1,239]	{619}
Union	61,339	61,358	61,378	61,397	61,432	(12,286)	[2,949]	{1,474}	61,464	(12,293)	[2,950]	{1,475}	61,495	(12,299)	[2,952]	{1,476}
Wake	287,831	287,954	288,076	288,199	288,488	(57,698)	[13,847]	{6,924}	288,756	(57,751)	[13,860]	{6,930}	289,018	(57,804)	[13,873]	{6,936}

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.