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

Date: 2/16/22

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 2/16/22 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.

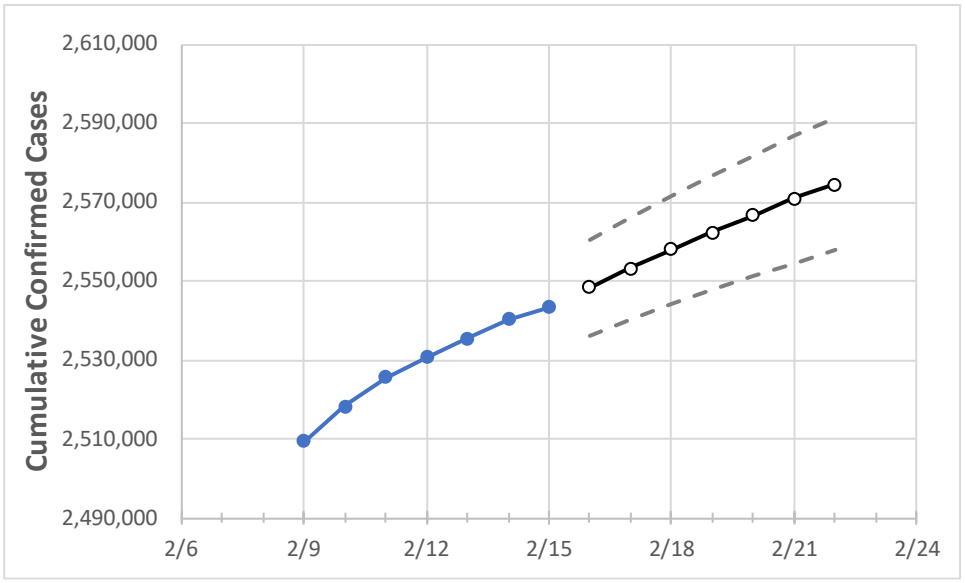
IEM's Modeling Lead

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:						
	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22
North Carolina	2,530,613	2,535,493	2,540,372	2,543,260	2,548,403	2,553,176	2,558,124	2,562,341	2,566,754	2,570,868	2,574,579

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:						
	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22
Cumberland	79,722	79,916	80,109	80,250	80,502	80,711	80,916	81,111	81,315	81,490	81,657
Durham	67,286	67,431	67,577	67,679	67,819	67,967	68,096	68,222	68,345	68,465	68,573
Guilford	111,752	111,955	112,159	112,294	112,483	112,662	112,827	112,987	113,144	113,293	113,432
Mecklenburg	269,861	270,250	270,639	270,861	271,236	271,586	271,928	272,257	272,547	272,849	273,109
Orange	24,681	24,761	24,841	24,894	24,975	25,053	25,126	25,196	25,266	25,329	25,396
Union	59,791	59,874	59,958	60,011	60,105	60,195	60,279	60,361	60,436	60,510	60,575
Wake	279,398	280,051	280,703	281,077	281,707	282,302	282,892	283,421	283,961	284,456	284,907

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:											
	2/12	2/13	2/14	2/15	2/17				2/19				2/21			
Cumberland	79,722	79,916	80,109	80,250	80,711	(16,142)	[3,874]	{1,937}	81,111	(16,222)	[3,893]	{1,947}	81,490	(16,298)	[3,912]	{1,956}
Durham	67,286	67,431	67,577	67,679	67,967	(13,593)	[3,262]	{1,631}	68,222	(13,644)	[3,275]	{1,637}	68,465	(13,693)	[3,286]	{1,643}
Guilford	111,752	111,955	112,159	112,294	112,662	(22,532)	[5,408]	{2,704}	112,987	(22,597)	[5,423]	{2,712}	113,293	(22,659)	[5,438]	{2,719}
Mecklenburg	269,861	270,250	270,639	270,861	271,586	(54,317)	[13,036]	{6,518}	272,257	(54,451)	[13,068]	{6,534}	272,849	(54,570)	[13,097]	{6,548}
Orange	24,681	24,761	24,841	24,894	25,053	(5,011)	[1,203]	{601}	25,196	(5,039)	[1,209]	{605}	25,329	(5,066)	[1,216]	{608}
Union	59,791	59,874	59,958	60,011	60,195	(12,039)	[2,889]	{1,445}	60,361	(12,072)	[2,897]	{1,449}	60,510	(12,102)	[2,904]	{1,452}
Wake	279,398	280,051	280,703	281,077	282,302	(56,460)	[13,550]	{6,775}	283,421	(56,684)	[13,604]	{6,802}	284,456	(56,891)	[13,654]	{6,827}

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.