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

Date: 2/18/22

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 2/18/22 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.

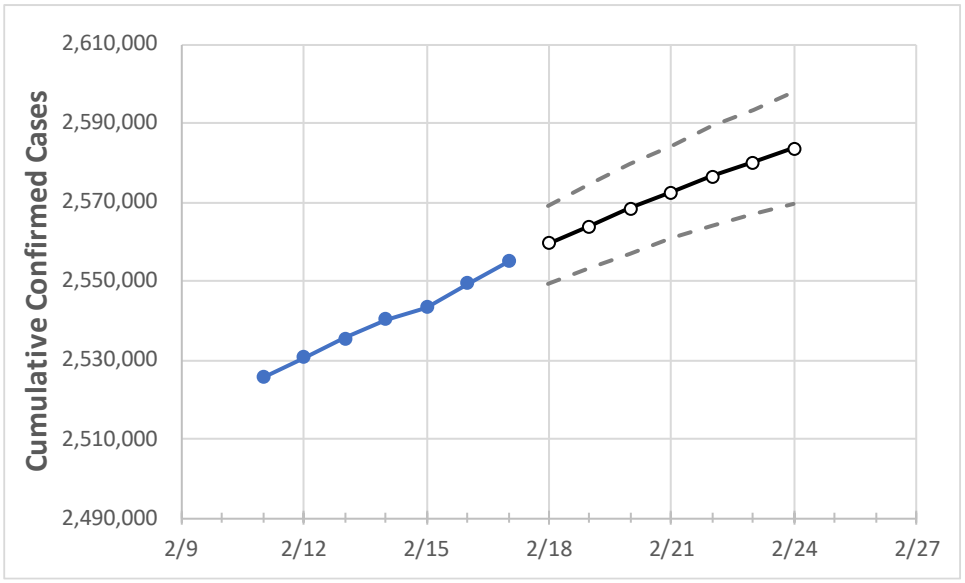
IEM's Modeling Lead

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:						
	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23	2/24
North Carolina	2,540,372	2,543,260	2,549,339	2,554,922	2,559,534	2,563,933	2,568,295	2,572,405	2,576,419	2,580,085	2,583,662

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:						
	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23	2/24
Cumberland	80,109	80,250	80,416	80,588	80,744	80,891	81,030	81,165	81,290	81,417	81,526
Durham	67,577	67,679	67,823	67,968	68,098	68,224	68,345	68,461	68,567	68,677	68,778
Guilford	112,159	112,294	112,510	112,690	112,866	113,031	113,187	113,337	113,480	113,623	113,747
Mecklenburg	270,639	270,861	271,580	272,050	272,416	272,801	273,122	273,439	273,781	274,067	274,348
Orange	24,841	24,894	24,944	25,026	25,095	25,163	25,227	25,289	25,348	25,405	25,460
Union	59,958	60,011	60,227	60,340	60,434	60,522	60,605	60,690	60,770	60,847	60,913
Wake	280,703	281,077	281,534	282,031	282,589	283,133	283,583	284,071	284,520	284,986	285,388

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:											
	2/14	2/15	2/16	2/17	2/19				2/21				2/23			
Cumberland	80,109	80,250	80,416	80,588	80,891	(16,178)	[3,883]	{1,941}	81,165	(16,233)	[3,896]	{1,948}	81,417	(16,283)	[3,908]	{1,954}
Durham	67,577	67,679	67,823	67,968	68,224	(13,645)	[3,275]	{1,637}	68,461	(13,692)	[3,286]	{1,643}	68,677	(13,735)	[3,296]	{1,648}
Guilford	112,159	112,294	112,510	112,690	113,031	(22,606)	[5,425]	{2,713}	113,337	(22,667)	[5,440]	{2,720}	113,623	(22,725)	[5,454]	{2,727}
Mecklenburg	270,639	270,861	271,580	272,050	272,801	(54,560)	[13,094]	{6,547}	273,439	(54,688)	[13,125]	{6,563}	274,067	(54,813)	[13,155]	{6,578}
Orange	24,841	24,894	24,944	25,026	25,163	(5,033)	[1,208]	{604}	25,289	(5,058)	[1,214]	{607}	25,405	(5,081)	[1,219]	{610}
Union	59,958	60,011	60,227	60,340	60,522	(12,104)	[2,905]	{1,453}	60,690	(12,138)	[2,913]	{1,457}	60,847	(12,169)	[2,921]	{1,460}
Wake	280,703	281,077	281,534	282,031	283,133	(56,627)	[13,590]	{6,795}	284,071	(56,814)	[13,635]	{6,818}	284,986	(56,997)	[13,679]	{6,840}

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.