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

Date: 1/28/22

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 1/28/22 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.

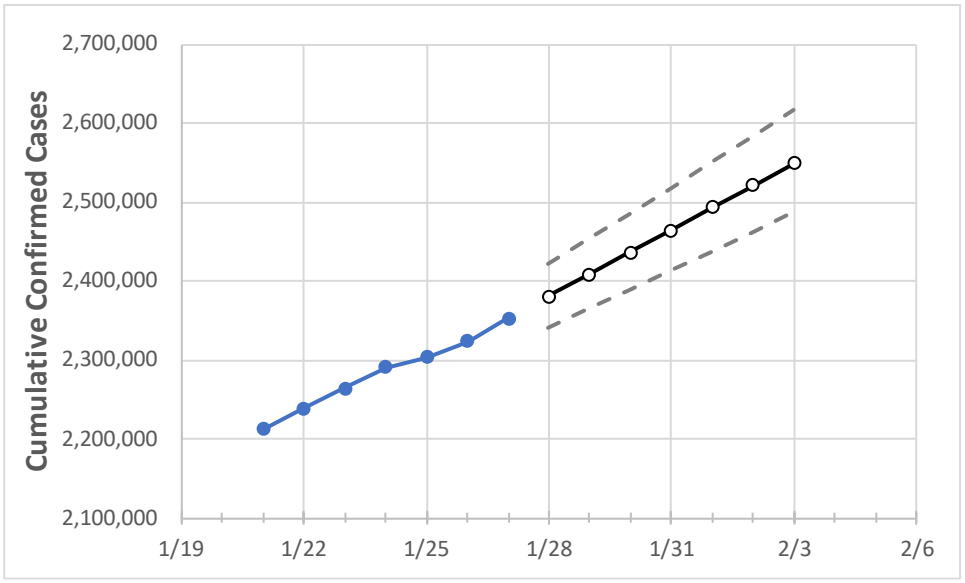
IEM's Modeling Lead

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:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3
North Carolina	2,290,179	2,303,196	2,323,482	2,352,235	2,380,579	2,408,117	2,435,747	2,463,991	2,492,851	2,520,646	2,549,588

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:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3
Cumberland	69,190	70,058	70,677	71,669	72,617	73,579	74,564	75,540	76,550	77,560	78,602
Durham	60,743	61,454	62,073	62,648	63,412	64,173	64,904	65,640	66,367	67,090	67,824
Guilford	103,041	103,880	104,506	105,316	106,736	108,144	109,569	110,983	112,429	113,920	115,446
Mecklenburg	246,990	249,883	251,866	254,987	257,933	260,982	263,994	266,961	270,033	273,155	276,079
Orange	21,049	21,419	21,774	22,169	22,539	22,925	23,305	23,689	24,081	24,483	24,879
Union	54,370	54,710	55,199	56,271	56,957	57,642	58,344	59,043	59,760	60,480	61,209
Wake	249,842	251,883	254,935	258,153	261,727	265,260	268,732	272,202	275,525	278,920	282,409

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:											
	1/24	1/25	1/26	1/27	1/29				1/31				2/2			
Cumberland	69,190	70,058	70,677	71,669	73,579	(14,716)	[3,532]	{1,766}	75,540	(15,108)	[3,626]	{1,813}	77,560	(15,512)	[3,723]	{1,861}
Durham	60,743	61,454	62,073	62,648	64,173	(12,835)	[3,080]	{1,540}	65,640	(13,128)	[3,151]	{1,575}	67,090	(13,418)	[3,220]	{1,610}
Guilford	103,041	103,880	104,506	105,316	108,144	(21,629)	[5,191]	{2,595}	110,983	(22,197)	[5,327]	{2,664}	113,920	(22,784)	[5,468]	{2,734}
Mecklenburg	246,990	249,883	251,866	254,987	260,982	(52,196)	[12,527]	{6,264}	266,961	(53,392)	[12,814]	{6,407}	273,155	(54,631)	[13,111]	{6,556}
Orange	21,049	21,419	21,774	22,169	22,925	(4,585)	[1,100]	{550}	23,689	(4,738)	[1,137]	{569}	24,483	(4,897)	[1,175]	{588}
Union	54,370	54,710	55,199	56,271	57,642	(11,528)	[2,767]	{1,383}	59,043	(11,809)	[2,834]	{1,417}	60,480	(12,096)	[2,903]	{1,452}
Wake	249,842	251,883	254,935	258,153	265,260	(53,052)	[12,732]	{6,366}	272,202	(54,440)	[13,066]	{6,533}	278,920	(55,784)	[13,388]	{6,694}

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.