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

Date: 2/23/22

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 2/23/22 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.

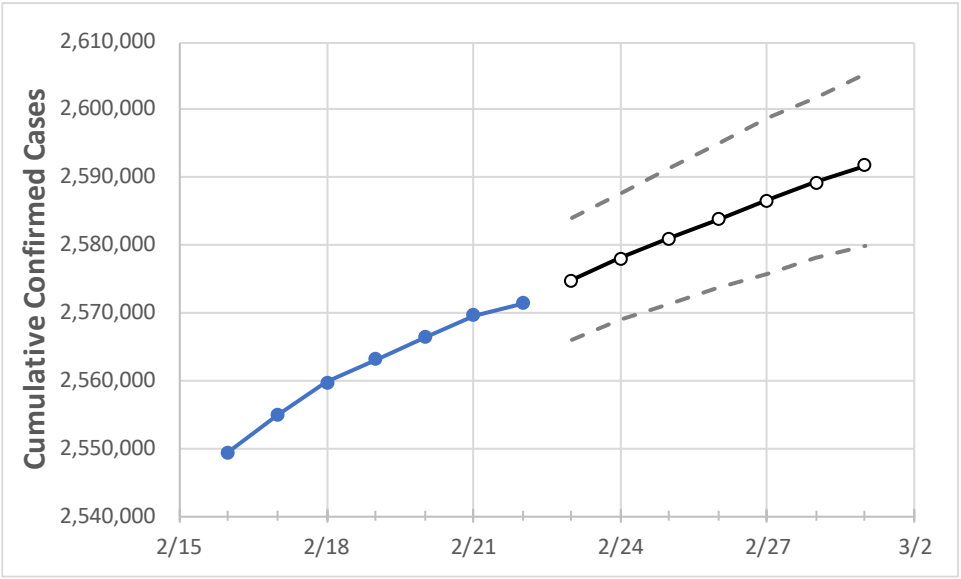
IEM's Modeling Lead

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
North Carolina	2,563,089	2,566,385	2,569,681	2,571,397	2,574,744	2,578,014	2,581,033	2,583,784	2,586,639	2,589,328	2,591,854

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Cumberland	80,850	80,972	81,094	81,135	81,238	81,334	81,429	81,515	81,598	81,677	81,750
Durham	68,187	68,287	68,387	68,501	68,609	68,706	68,801	68,896	68,989	69,070	69,153
Guilford	113,132	113,277	113,421	113,522	113,660	113,802	113,929	114,054	114,179	114,299	114,409
Mecklenburg	272,714	273,011	273,308	273,628	273,934	274,227	274,503	274,785	275,039	275,300	275,532
Orange	25,127	25,165	25,202	25,234	25,278	25,320	25,360	25,400	25,436	25,472	25,506
Union	60,510	60,570	60,630	60,686	60,761	60,828	60,897	60,952	61,016	61,075	61,135
Wake	282,830	283,157	283,484	283,678	284,043	284,388	284,706	284,997	285,283	285,575	285,830

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:											
	2/19	2/20	2/21	2/22	2/24				2/26				2/28			
Cumberland	80,850	80,972	81,094	81,135	81,334	(16,267)	[3,904]	{1,952}	81,515	(16,303)	[3,913]	{1,956}	81,677	(16,335)	[3,921]	{1,960}
Durham	68,187	68,287	68,387	68,501	68,706	(13,741)	[3,298]	{1,649}	68,896	(13,779)	[3,307]	{1,654}	69,070	(13,814)	[3,315]	{1,658}
Guilford	113,132	113,277	113,421	113,522	113,802	(22,760)	[5,463]	{2,731}	114,054	(22,811)	[5,475]	{2,737}	114,299	(22,860)	[5,486]	{2,743}
Mecklenburg	272,714	273,011	273,308	273,628	274,227	(54,845)	[13,163]	{6,581}	274,785	(54,957)	[13,190]	{6,595}	275,300	(55,060)	[13,214]	{6,607}
Orange	25,127	25,165	25,202	25,234	25,320	(5,064)	[1,215]	{608}	25,400	(5,080)	[1,219]	{610}	25,472	(5,094)	[1,223]	{611}
Union	60,510	60,570	60,630	60,686	60,828	(12,166)	[2,920]	{1,460}	60,952	(12,190)	[2,926]	{1,463}	61,075	(12,215)	[2,932]	{1,466}
Wake	282,830	283,157	283,484	283,678	284,388	(56,878)	[13,651]	{6,825}	284,997	(56,999)	[13,680]	{6,840}	285,575	(57,115)	[13,708]	{6,854}

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.