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

Date: 3/29/22

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 3/29/22 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.

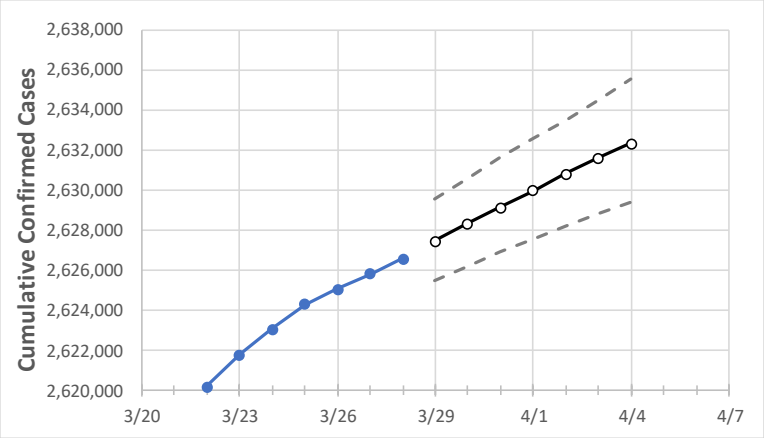
IEM's Modeling Lead

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:						
	3/25	3/26	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4
North Carolina	2,624,305	2,625,069	2,625,832	2,626,596	2,627,466	2,628,338	2,629,151	2,629,978	2,630,829	2,631,611	2,632,357

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:						
	3/25	3/26	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4
Cumberland	83,724	83,810	83,895	83,981	84,087	84,194	84,301	84,413	84,526	84,643	84,756
Durham	70,270	70,303	70,337	70,370	70,408	70,447	70,483	70,519	70,557	70,593	70,628
Guilford	116,190	116,210	116,231	116,251	116,287	116,325	116,358	116,390	116,423	116,455	116,488
Mecklenburg	277,286	277,345	277,404	277,463	277,536	277,606	277,675	277,743	277,810	277,876	277,944
Orange	25,966	25,980	25,994	26,008	26,027	26,045	26,063	26,081	26,099	26,117	26,134
Union	61,441	61,451	61,461	61,471	61,481	61,492	61,500	61,510	61,518	61,528	61,535
Wake	289,690	289,782	289,874	289,966	290,068	290,169	290,265	290,363	290,461	290,552	290,643

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:											
	3/25	3/26	3/27	3/28	3/30				4/1				4/3			
Cumberland	83,724	83,810	83,895	83,981	84,194	(16,839)	[4,041]	{2,021}	84,413	(16,883)	[4,052]	{2,026}	84,643	(16,929)	[4,063]	{2,031}
Durham	70,270	70,303	70,337	70,370	70,447	(14,089)	[3,381]	{1,691}	70,519	(14,104)	[3,385]	{1,692}	70,593	(14,119)	[3,388]	{1,694}
Guilford	116,190	116,210	116,231	116,251	116,325	(23,265)	[5,584]	{2,792}	116,390	(23,278)	[5,587]	{2,793}	116,455	(23,291)	[5,590]	{2,795}
Mecklenburg	277,286	277,345	277,404	277,463	277,606	(55,521)	[13,325]	{6,663}	277,743	(55,549)	[13,332]	{6,666}	277,876	(55,575)	[13,338]	{6,669}
Orange	25,966	25,980	25,994	26,008	26,045	(5,209)	[1,250]	{625}	26,081	(5,216)	[1,252]	{626}	26,117	(5,223)	[1,254]	{627}
Union	61,441	61,451	61,461	61,471	61,492	(12,298)	[2,952]	{1,476}	61,510	(12,302)	[2,952]	{1,476}	61,528	(12,306)	[2,953]	{1,477}
Wake	289,690	289,782	289,874	289,966	290,169	(58,034)	[13,928]	{6,964}	290,363	(58,073)	[13,937]	{6,969}	290,552	(58,110)	[13,946]	{6,973}

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.