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

Date: 4/1/21

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 4/1/21 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.

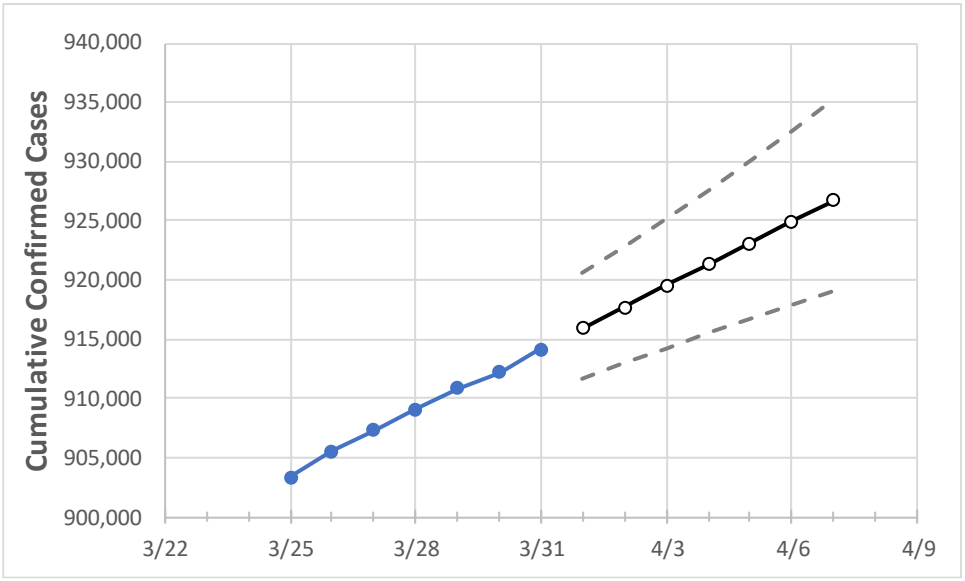
IEM's Modeling Lead

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:						
	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	4/6	4/7
North Carolina	909,065	910,833	912,203	914,132	915,927	917,712	919,529	921,317	923,125	924,925	926,724

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:						
	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	4/6	4/7
Cumberland	25,675	25,735	25,785	25,853	25,912	25,972	26,032	26,091	26,152	26,213	26,273
Durham	23,022	23,072	23,105	23,156	23,223	23,290	23,357	23,426	23,496	23,565	23,633
Guilford	42,560	42,686	42,760	42,862	42,982	43,104	43,228	43,354	43,481	43,611	43,743
Mecklenburg	102,080	102,319	102,517	102,725	102,965	103,211	103,458	103,704	103,957	104,209	104,474
Orange	8,041	8,059	8,069	8,077	8,093	8,110	8,127	8,144	8,160	8,177	8,195
Union	22,198	22,236	22,297	22,381	22,443	22,507	22,571	22,635	22,698	22,766	22,835
Wake	79,949	80,144	80,281	80,510	80,717	80,931	81,150	81,373	81,596	81,813	82,033

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:											
	3/28	3/29	3/30	3/31	4/2				4/4				4/6			
Cumberland	25,675	25,735	25,785	25,853	25,972	(5,194)	[1,247]	{623}	26,091	(5,218)	[1,252]	{626}	26,213	(5,243)	[1,258]	{629}
Durham	23,022	23,072	23,105	23,156	23,290	(4,658)	[1,118]	{559}	23,426	(4,685)	[1,124]	{562}	23,565	(4,713)	[1,131]	{566}
Guilford	42,560	42,686	42,760	42,862	43,104	(8,621)	[2,069]	{1,035}	43,354	(8,671)	[2,081]	{1,040}	43,611	(8,722)	[2,093]	{1,047}
Mecklenburg	102,080	102,319	102,517	102,725	103,211	(20,642)	[4,954]	{2,477}	103,704	(20,741)	[4,978]	{2,489}	104,209	(20,842)	[5,002]	{2,501}
Orange	8,041	8,059	8,069	8,077	8,110	(1,622)	[389]	{195}	8,144	(1,629)	[391]	{195}	8,177	(1,635)	[393]	{196}
Union	22,198	22,236	22,297	22,381	22,507	(4,501)	[1,080]	{540}	22,635	(4,527)	[1,086]	{543}	22,766	(4,553)	[1,093]	{546}
Wake	79,949	80,144	80,281	80,510	80,931	(16,186)	[3,885]	{1,942}	81,373	(16,275)	[3,906]	{1,953}	81,813	(16,363)	[3,927]	{1,964}

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.