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

Date: 10/29/21

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 10/29/21 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.

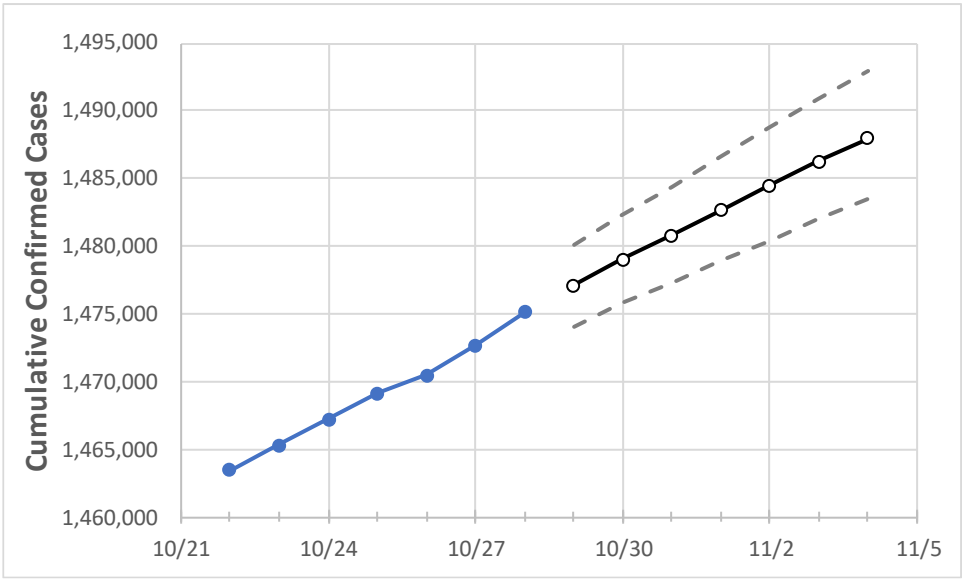
IEM's Modeling Lead

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:						
	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1	11/2	11/3	11/4
North Carolina	1,469,155	1,470,495	1,472,655	1,475,148	1,477,111	1,478,992	1,480,824	1,482,646	1,484,464	1,486,243	1,487,986

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:						
	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1	11/2	11/3	11/4
Cumberland	45,159	45,252	45,421	45,521	45,624	45,725	45,823	45,923	46,024	46,130	46,224
Durham	34,457	34,482	34,526	34,577	34,621	34,664	34,706	34,747	34,789	34,831	34,871
Guilford	67,579	67,649	67,719	67,832	67,925	68,014	68,099	68,185	68,269	68,351	68,429
Mecklenburg	156,529	156,694	156,828	157,039	157,197	157,353	157,505	157,657	157,808	157,953	158,098
Orange	11,776	11,789	11,807	11,829	11,845	11,860	11,875	11,890	11,906	11,920	11,934
Union	36,180	36,220	36,270	36,331	36,379	36,426	36,473	36,519	36,567	36,613	36,658
Wake	128,460	128,591	128,802	129,014	129,170	129,328	129,478	129,627	129,773	129,922	130,069

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:											
	10/25	10/26	10/27	10/28	10/30				11/1				11/3			
Cumberland	45,159	45,252	45,421	45,521	45,725	(9,145)	[2,195]	{1,097}	45,923	(9,185)	[2,204]	{1,102}	46,130	(9,226)	[2,214]	{1,107}
Durham	34,457	34,482	34,526	34,577	34,664	(6,933)	[1,664]	{832}	34,747	(6,949)	[1,668]	{834}	34,831	(6,966)	[1,672]	{836}
Guilford	67,579	67,649	67,719	67,832	68,014	(13,603)	[3,265]	{1,632}	68,185	(13,637)	[3,273]	{1,636}	68,351	(13,670)	[3,281]	{1,640}
Mecklenburg	156,529	156,694	156,828	157,039	157,353	(31,471)	[7,553]	{3,776}	157,657	(31,531)	[7,568]	{3,784}	157,953	(31,591)	[7,582]	{3,791}
Orange	11,776	11,789	11,807	11,829	11,860	(2,372)	[569]	{285}	11,890	(2,378)	[571]	{285}	11,920	(2,384)	[572]	{286}
Union	36,180	36,220	36,270	36,331	36,426	(7,285)	[1,748]	{874}	36,519	(7,304)	[1,753]	{876}	36,613	(7,323)	[1,757]	{879}
Wake	128,460	128,591	128,802	129,014	129,328	(25,866)	[6,208]	{3,104}	129,627	(25,925)	[6,222]	{3,111}	129,922	(25,984)	[6,236]	{3,118}

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.