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

Date: 10/13/21

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 10/13/21 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.

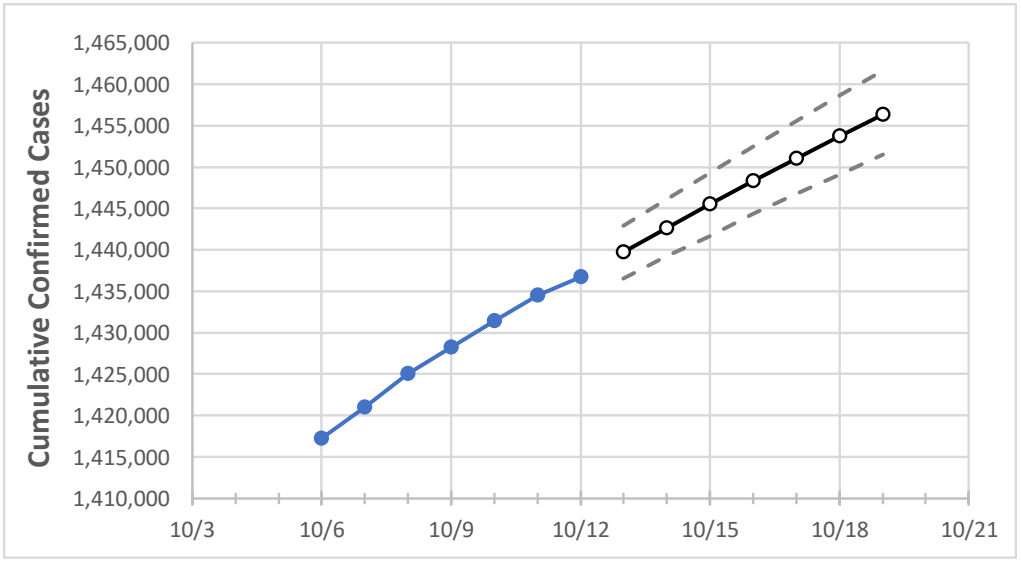
IEM's Modeling Lead

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:						
	10/9	10/10	10/11	10/12	10/13	10/14	10/15	10/16	10/17	10/18	10/19
North Carolina	1,428,225	1,431,388	1,434,551	1,436,699	1,439,692	1,442,618	1,445,473	1,448,273	1,450,983	1,453,683	1,456,348

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:						
	10/9	10/10	10/11	10/12	10/13	10/14	10/15	10/16	10/17	10/18	10/19
Cumberland	43,442	43,550	43,659	43,737	43,872	44,007	44,141	44,272	44,405	44,538	44,669
Durham	33,617	33,673	33,729	33,775	33,833	33,890	33,946	34,003	34,058	34,113	34,166
Guilford	65,598	65,735	65,872	65,987	66,158	66,331	66,499	66,669	66,831	66,998	67,153
Mecklenburg	153,310	153,538	153,765	153,971	154,218	154,462	154,695	154,928	155,150	155,379	155,595
Orange	11,464	11,487	11,511	11,523	11,550	11,577	11,603	11,628	11,654	11,681	11,706
Union	35,228	35,292	35,357	35,432	35,502	35,572	35,641	35,708	35,774	35,838	35,902
Wake	125,119	125,495	125,870	125,971	126,201	126,434	126,650	126,874	127,098	127,308	127,533

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:											
	10/9	10/10	10/11	10/12	10/14				10/16				10/18			
Cumberland	43,442	43,550	43,659	43,737	44,007	(8,801)	[2,112]	{1,056}	44,272	(8,854)	[2,125]	{1,063}	44,538	(8,908)	[2,138]	{1,069}
Durham	33,617	33,673	33,729	33,775	33,890	(6,778)	[1,627]	{813}	34,003	(6,801)	[1,632]	{816}	34,113	(6,823)	[1,637]	{819}
Guilford	65,598	65,735	65,872	65,987	66,331	(13,266)	[3,184]	{1,592}	66,669	(13,334)	[3,200]	{1,600}	66,998	(13,400)	[3,216]	{1,608}
Mecklenburg	153,310	153,538	153,765	153,971	154,462	(30,892)	[7,414]	{3,707}	154,928	(30,986)	[7,437]	{3,718}	155,379	(31,076)	[7,458]	{3,729}
Orange	11,464	11,487	11,511	11,523	11,577	(2,315)	[556]	{278}	11,628	(2,326)	[558]	{279}	11,681	(2,336)	[561]	{280}
Union	35,228	35,292	35,357	35,432	35,572	(7,114)	[1,707]	{854}	35,708	(7,142)	[1,714]	{857}	35,838	(7,168)	[1,720]	{860}
Wake	125,119	125,495	125,870	125,971	126,434	(25,287)	[6,069]	{3,034}	126,874	(25,375)	[6,090]	{3,045}	127,308	(25,462)	[6,111]	{3,055}

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.