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

Date: 9/22/21

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 9/22/21 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.

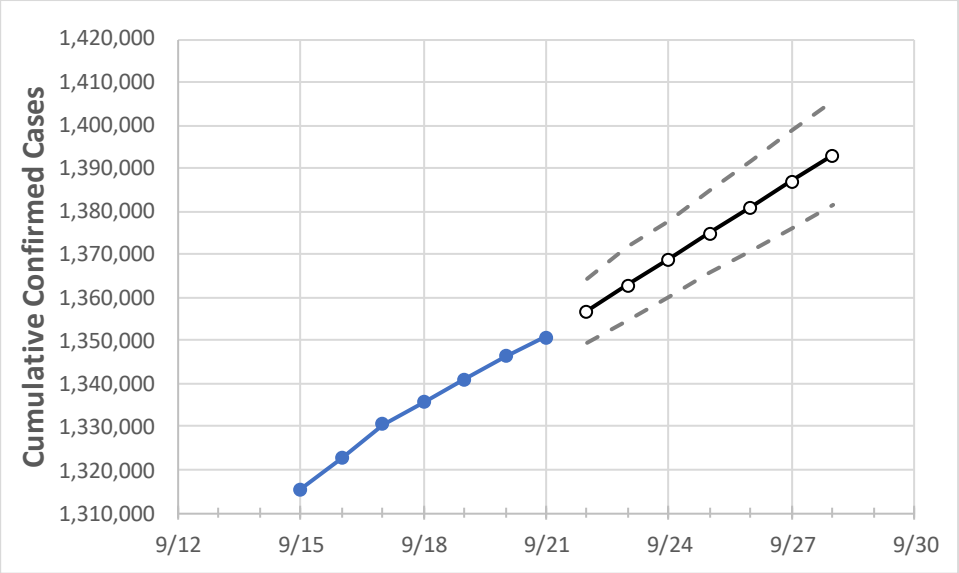
IEM's Modeling Lead

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:						
	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28
North Carolina	1,335,767	1,341,041	1,346,316	1,350,697	1,356,776	1,362,852	1,368,812	1,374,917	1,380,989	1,386,951	1,392,952

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:						
	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28
Cumberland	40,535	40,653	40,770	40,864	41,010	41,152	41,289	41,427	41,568	41,708	41,841
Durham	32,067	32,165	32,262	32,312	32,400	32,488	32,575	32,660	32,744	32,827	32,912
Guilford	60,595	60,866	61,136	61,326	61,573	61,831	62,081	62,329	62,595	62,848	63,105
Mecklenburg	145,209	145,624	146,038	146,601	147,102	147,607	148,104	148,598	149,096	149,600	150,088
Orange	10,742	10,778	10,814	10,829	10,866	10,900	10,935	10,971	11,006	11,042	11,074
Union	33,020	33,136	33,251	33,423	33,610	33,794	33,977	34,159	34,346	34,531	34,716
Wake	118,763	119,182	119,602	119,767	120,199	120,621	121,052	121,474	121,865	122,291	122,705

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:											
	9/18	9/19	9/20	9/21	9/23				9/25				9/27			
Cumberland	40,535	40,653	40,770	40,864	41,152	(8,230)	[1,975]	{988}	41,427	(8,285)	[1,989]	{994}	41,708	(8,342)	[2,002]	{1,001}
Durham	32,067	32,165	32,262	32,312	32,488	(6,498)	[1,559]	{780}	32,660	(6,532)	[1,568]	{784}	32,827	(6,565)	[1,576]	{788}
Guilford	60,595	60,866	61,136	61,326	61,831	(12,366)	[2,968]	{1,484}	62,329	(12,466)	[2,992]	{1,496}	62,848	(12,570)	[3,017]	{1,508}
Mecklenburg	145,209	145,624	146,038	146,601	147,607	(29,521)	[7,085]	{3,543}	148,598	(29,720)	[7,133]	{3,566}	149,600	(29,920)	[7,181]	{3,590}
Orange	10,742	10,778	10,814	10,829	10,900	(2,180)	[523]	{262}	10,971	(2,194)	[527]	{263}	11,042	(2,208)	[530]	{265}
Union	33,020	33,136	33,251	33,423	33,794	(6,759)	[1,622]	{811}	34,159	(6,832)	[1,640]	{820}	34,531	(6,906)	[1,657]	{829}
Wake	118,763	119,182	119,602	119,767	120,621	(24,124)	[5,790]	{2,895}	121,474	(24,295)	[5,831]	{2,915}	122,291	(24,458)	[5,870]	{2,935}

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.