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

Date: 9/24/21

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 9/24/21 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.

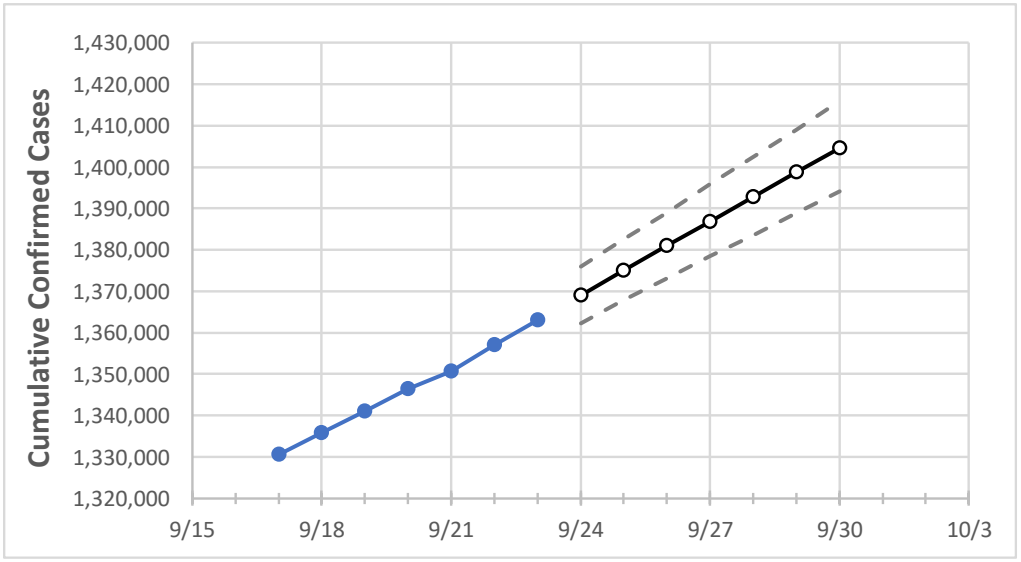
IEM's Modeling Lead

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:						
	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30
North Carolina	1,346,316	1,350,697	1,356,985	1,362,938	1,368,996	1,374,947	1,380,897	1,386,828	1,392,848	1,398,776	1,404,627

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:						
	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30
Cumberland	40,770	40,864	41,025	41,123	41,259	41,394	41,525	41,658	41,788	41,916	42,048
Durham	32,262	32,312	32,389	32,469	32,553	32,639	32,719	32,802	32,882	32,963	33,045
Guilford	61,136	61,326	61,662	61,939	62,206	62,475	62,746	63,017	63,295	63,572	63,856
Mecklenburg	146,038	146,601	147,294	147,806	148,328	148,831	149,351	149,876	150,389	150,920	151,444
Orange	10,814	10,829	10,875	10,889	10,923	10,956	10,988	11,020	11,052	11,085	11,115
Union	33,251	33,423	33,603	33,712	33,887	34,062	34,234	34,407	34,578	34,758	34,926
Wake	119,602	119,767	120,279	120,704	121,129	121,560	121,969	122,392	122,801	123,210	123,628

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:		
	9/20	9/21	9/22	9/23	9/25	9/27	9/29
Cumberland	40,770	40,864	41,025	41,123	41,394 (8,279) [1,987] {993}	41,658 (8,332) [2,000] {1,000}	41,916 (8,383) [2,012] {1,006}
Durham	32,262	32,312	32,389	32,469	32,639 (6,528) [1,567] {783}	32,802 (6,560) [1,575] {787}	32,963 (6,593) [1,582] {791}
Guilford	61,136	61,326	61,662	61,939	62,475 (12,495) [2,999] {1,499}	63,017 (12,603) [3,025] {1,512}	63,572 (12,714) [3,051] {1,526}
Mecklenburg	146,038	146,601	147,294	147,806	148,831 (29,766) [7,144] {3,572}	149,876 (29,975) [7,194] {3,597}	150,920 (30,184) [7,244] {3,622}
Orange	10,814	10,829	10,875	10,889	10,956 (2,191) [526] {263}	11,020 (2,204) [529] {264}	11,085 (2,217) [532] {266}
Union	33,251	33,423	33,603	33,712	34,062 (6,812) [1,635] {817}	34,407 (6,881) [1,652] {826}	34,758 (6,952) [1,668] {834}
Wake	119,602	119,767	120,279	120,704	121,560 (24,312) [5,835] {2,917}	122,392 (24,478) [5,875] {2,937}	123,210 (24,642) [5,914] {2,957}

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.