IEM's AI Modeling: Short-term COVID-19 Projections
Date: 10/20/21

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 10/20/21 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
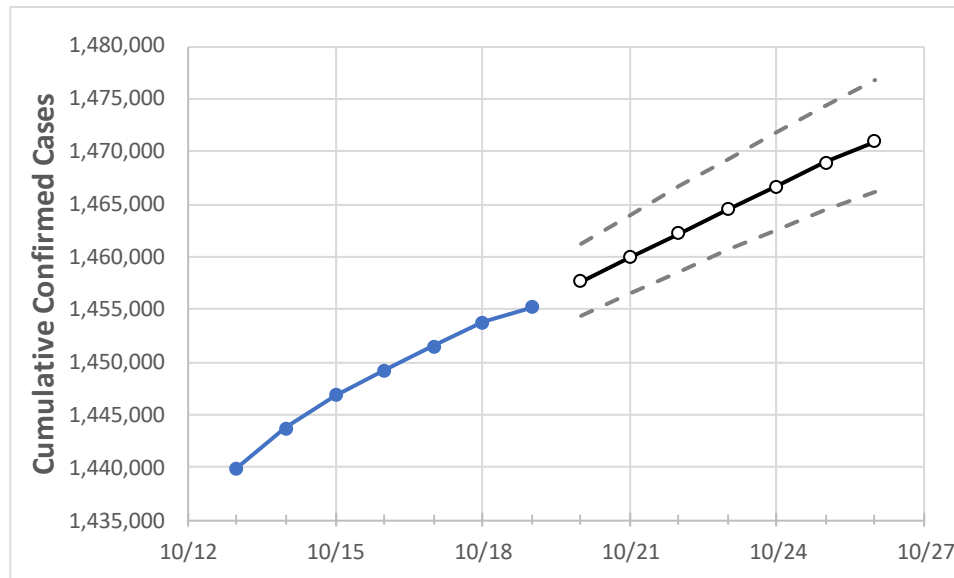
	Actual Confirmed Cases On:				Projected Cases For:						
	10/16	10/17	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26
North Carolina	1,449,192	1,451,503	1,453,814	1,455,188	1,457,636	1,459,962	1,462,244	1,464,495	1,466,689	1,468,916	1,470,992

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:						
	10/16	10/17	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26
Cumberland	44,177	44,255	44,333	44,378	44,470	44,559	44,646	44,730	44,816	44,899	44,983
Durham	34,016	34,069	34,122	34,152	34,203	34,253	34,302	34,350	34,397	34,445	34,491
Guilford	66,573	66,691	66,809	66,883	67,006	67,127	67,241	67,355	67,467	67,574	67,678
Mecklenburg	154,912	155,105	155,299	155,457	155,650	155,840	156,021	156,206	156,385	156,562	156,730
Orange	11,625	11,650	11,675	11,679	11,699	11,719	11,738	11,757	11,776	11,796	11,815
Union	35,698	35,742	35,785	35,826	35,883	35,938	35,992	36,045	36,098	36,148	36,198
Wake	126,974	127,161	127,347	127,393	127,585	127,785	127,955	128,140	128,327	128,507	128,680

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:		
	10/16	10/17	10/18	10/19	10/21	10/23	10/25
Cumberland	44,177	44,255	44,333	44,378	44,559 (8,912) [2,139] {1,069}	44,730 (8,946) [2,147] {1,074}	44,899 (8,980) [2,155] {1,078}
Durham	34,016	34,069	34,122	34,152	34,253 (6,851) [1,644] {822}	34,350 (6,870) [1,649] {824}	34,445 (6,889) [1,653] {827}
Guilford	66,573	66,691	66,809	66,883	67,127 (13,425) [3,222] {1,611}	67,355 (13,471) [3,233] {1,617}	67,574 (13,515) [3,244] {1,622}
Mecklenburg	154,912	155,105	155,299	155,457	155,840 (31,168) [7,480] {3,740}	156,206 (31,241) [7,498] {3,749}	156,562 (31,312) [7,515] {3,757}
Orange	11,625	11,650	11,675	11,679	11,719 (2,344) [563] {281}	11,757 (2,351) [564] {282}	11,796 (2,359) [566] {283}
Union	35,698	35,742	35,785	35,826	35,938 (7,188) [1,725] {863}	36,045 (7,209) [1,730] {865}	36,148 (7,230) [1,735] {868}
Wake	126,974	127,161	127,347	127,393	127,785 (25,557) [6,134] {3,067}	128,140 (25,628) [6,151] {3,075}	128,507 (25,701) [6,168] {3,084}

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.