IEM's AI Modeling: Short-term COVID-19 Projections
Date: 5/28/21

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 5/28/21 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
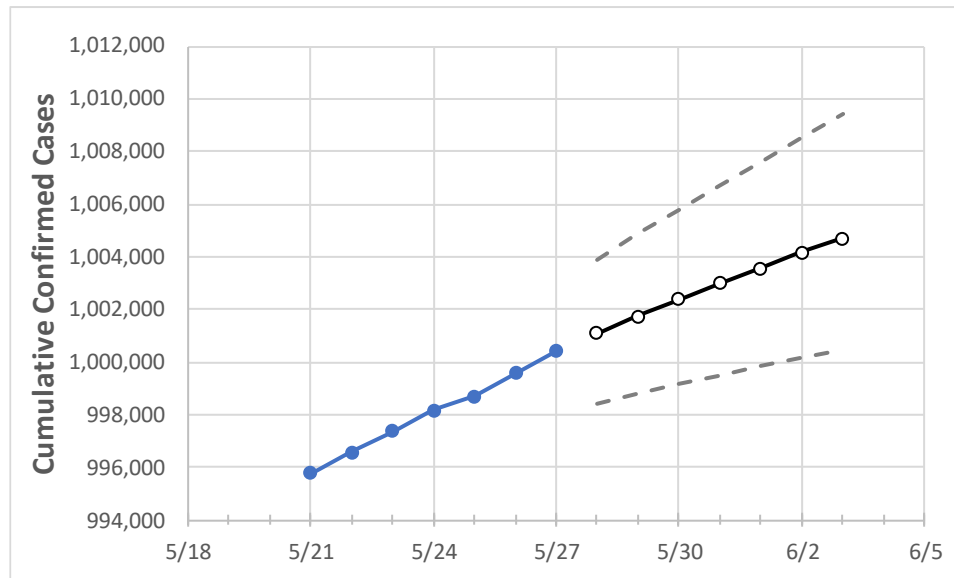
	Actual Confirmed Cases On:				Projected Cases For:						
	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31	6/1	6/2	6/3
North Carolina	998,176	998,701	999,567	1,000,416	1,001,092	1,001,735	1,002,377	1,002,998	1,003,565	1,004,168	1,004,712

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:						
	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31	6/1	6/2	6/3
Cumberland	29,406	29,446	29,483	29,531	29,572	29,612	29,652	29,690	29,728	29,765	29,800
Durham	25,464	25,473	25,490	25,513	25,524	25,535	25,545	25,555	25,564	25,572	25,580
Guilford	48,024	48,039	48,103	48,132	48,156	48,179	48,201	48,221	48,239	48,256	48,272
Mecklenburg	112,976	113,036	113,083	113,177	113,240	113,301	113,360	113,418	113,472	113,526	113,576
Orange	8,559	8,558	8,562	8,565	8,568	8,572	8,575	8,579	8,582	8,585	8,588
Union	24,627	24,629	24,637	24,648	24,658	24,667	24,676	24,684	24,691	24,698	24,705
Wake	88,461	88,496	88,575	88,671	88,734	88,798	88,858	88,916	88,972	89,028	89,081

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:		
	5/24	5/25	5/26	5/27	5/29	5/31	6/2
Cumberland	29,406	29,446	29,483	29,531	29,612 (5,922) [1,421] {711}	29,690 (5,938) [1,425] {713}	29,765 (5,953) [1,429] {714}
Durham	25,464	25,473	25,490	25,513	25,535 (5,107) [1,226] {613}	25,555 (5,111) [1,227] {613}	25,572 (5,114) [1,227] {614}
Guilford	48,024	48,039	48,103	48,132	48,179 (9,636) [2,313] {1,156}	48,221 (9,644) [2,315] {1,157}	48,256 (9,651) [2,316] {1,158}
Mecklenburg	112,976	113,036	113,083	113,177	113,301 (22,660) [5,438] {2,719}	113,418 (22,684) [5,444] {2,722}	113,526 (22,705) [5,449] {2,725}
Orange	8,559	8,558	8,562	8,565	8,572 (1,714) [411] {206}	8,579 (1,716) [412] {206}	8,585 (1,717) [412] {206}
Union	24,627	24,629	24,637	24,648	24,667 (4,933) [1,184] {592}	24,684 (4,937) [1,185] {592}	24,698 (4,940) [1,186] {593}
Wake	88,461	88,496	88,575	88,671	88,798 (17,760) [4,262] {2,131}	88,916 (17,783) [4,268] {2,134}	89,028 (17,806) [4,273] {2,137}

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.