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

Date: 4/27/21

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 4/27/21 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.

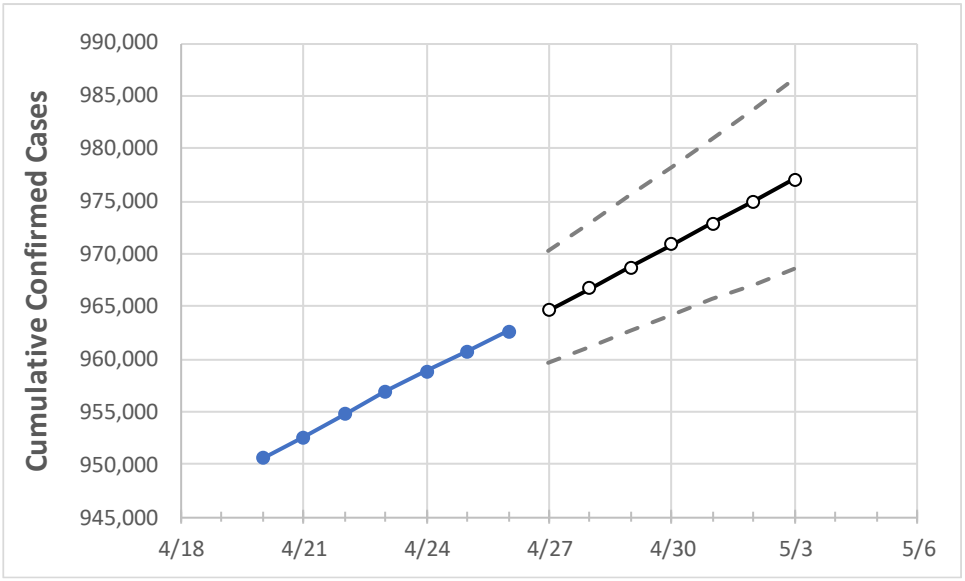
IEM's Modeling Lead

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:						
	4/23	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3
North Carolina	956,932	958,829	960,726	962,623	964,643	966,698	968,750	970,865	972,882	974,997	977,074

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:						
	4/23	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3
Cumberland	27,263	27,363	27,462	27,562	27,649	27,737	27,828	27,921	28,018	28,115	28,216
Durham	24,460	24,504	24,548	24,592	24,648	24,702	24,758	24,812	24,869	24,924	24,977
Guilford	45,781	45,904	46,028	46,151	46,281	46,412	46,546	46,681	46,816	46,950	47,088
Mecklenburg	108,485	108,702	108,918	109,135	109,388	109,633	109,881	110,134	110,384	110,634	110,887
Orange	8,387	8,400	8,414	8,427	8,440	8,453	8,467	8,480	8,493	8,506	8,519
Union	23,659	23,706	23,752	23,799	23,861	23,924	23,986	24,049	24,113	24,176	24,239
Wake	84,764	84,982	85,201	85,419	85,597	85,776	85,956	86,132	86,314	86,498	86,676

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:		
	4/23	4/24	4/25	4/26	4/28	4/30	5/2
Cumberland	27,263	27,363	27,462	27,562	27,737 (5,547) [1,331] {666}	27,921 (5,584) [1,340] {670}	28,115 (5,623) [1,350] {675}
Durham	24,460	24,504	24,548	24,592	24,702 (4,940) [1,186] {593}	24,812 (4,962) [1,191] {595}	24,924 (4,985) [1,196] {598}
Guilford	45,781	45,904	46,028	46,151	46,412 (9,282) [2,228] {1,114}	46,681 (9,336) [2,241] {1,120}	46,950 (9,390) [2,254] {1,127}
Mecklenburg	108,485	108,702	108,918	109,135	109,633 (21,927) [5,262] {2,631}	110,134 (22,027) [5,286] {2,643}	110,634 (22,127) [5,310] {2,655}
Orange	8,387	8,400	8,414	8,427	8,453 (1,691) [406] {203}	8,480 (1,696) [407] {204}	8,506 (1,701) [408] {204}
Union	23,659	23,706	23,752	23,799	23,924 (4,785) [1,148] {574}	24,049 (4,810) [1,154] {577}	24,176 (4,835) [1,160] {580}
Wake	84,764	84,982	85,201	85,419	85,776 (17,155) [4,117] {2,059}	86,132 (17,226) [4,134] {2,067}	86,498 (17,300) [4,152] {2,076}

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.