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

Date: 2/22/21

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 2/22/21 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.

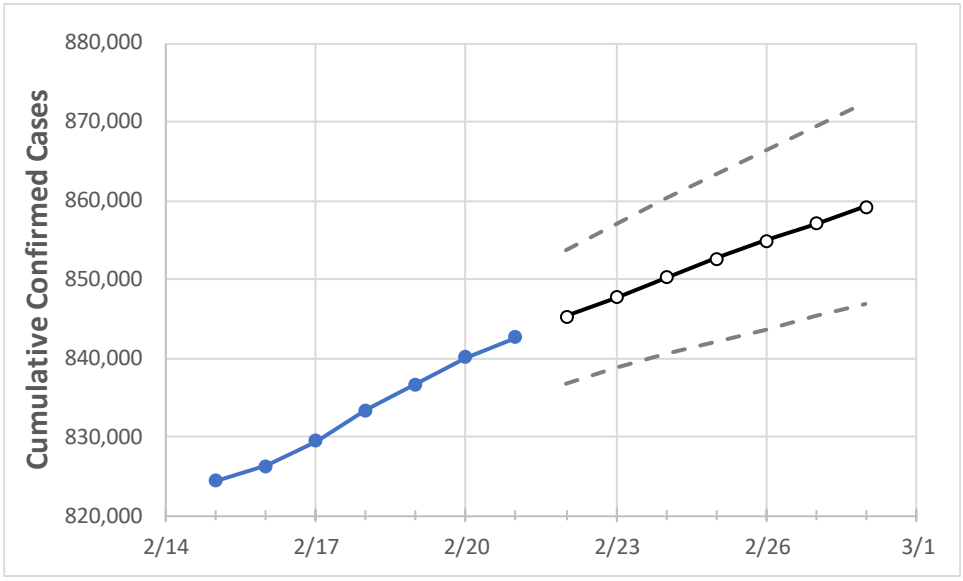
IEM's Modeling Lead

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:						
	2/18	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28
North Carolina	833,423	836,650	840,096	842,637	845,228	847,723	850,184	852,618	854,839	857,051	859,172

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:						
	2/18	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28
Cumberland	23,151	23,299	23,411	23,555	23,648	23,737	23,822	23,902	23,980	24,054	24,126
Durham	20,991	21,073	21,123	21,168	21,229	21,286	21,344	21,398	21,451	21,504	21,554
Guilford	38,705	38,848	38,935	38,991	39,092	39,192	39,287	39,376	39,463	39,543	39,621
Mecklenburg	94,018	94,306	94,622	94,829	95,088	95,337	95,583	95,817	96,035	96,248	96,448
Orange	7,515	7,541	7,555	7,565	7,589	7,611	7,632	7,653	7,674	7,694	7,713
Union	20,009	20,095	20,200	20,268	20,335	20,400	20,463	20,523	20,584	20,643	20,701
Wake	72,213	72,435	72,534	72,988	73,209	73,411	73,615	73,806	73,992	74,175	74,357

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:		
	2/18	2/19	2/20	2/21	2/23	2/25	2/27
Cumberland	23,151	23,299	23,411	23,555	23,737 (4,747) [1,139] {570}	23,902 (4,780) [1,147] {574}	24,054 (4,811) [1,155] {577}
Durham	20,991	21,073	21,123	21,168	21,286 (4,257) [1,022] {511}	21,398 (4,280) [1,027] {514}	21,504 (4,301) [1,032] {516}
Guilford	38,705	38,848	38,935	38,991	39,192 (7,838) [1,881] {941}	39,376 (7,875) [1,890] {945}	39,543 (7,909) [1,898] {949}
Mecklenburg	94,018	94,306	94,622	94,829	95,337 (19,067) [4,576] {2,288}	95,817 (19,163) [4,599] {2,300}	96,248 (19,250) [4,620] {2,310}
Orange	7,515	7,541	7,555	7,565	7,611 (1,522) [365] {183}	7,653 (1,531) [367] {184}	7,694 (1,539) [369] {185}
Union	20,009	20,095	20,200	20,268	20,400 (4,080) [979] {490}	20,523 (4,105) [985] {493}	20,643 (4,129) [991] {495}
Wake	72,213	72,435	72,534	72,988	73,411 (14,682) [3,524] {1,762}	73,806 (14,761) [3,543] {1,771}	74,175 (14,835) [3,560] {1,780}

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.