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

Date: 3/4/21

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 3/4/21 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.

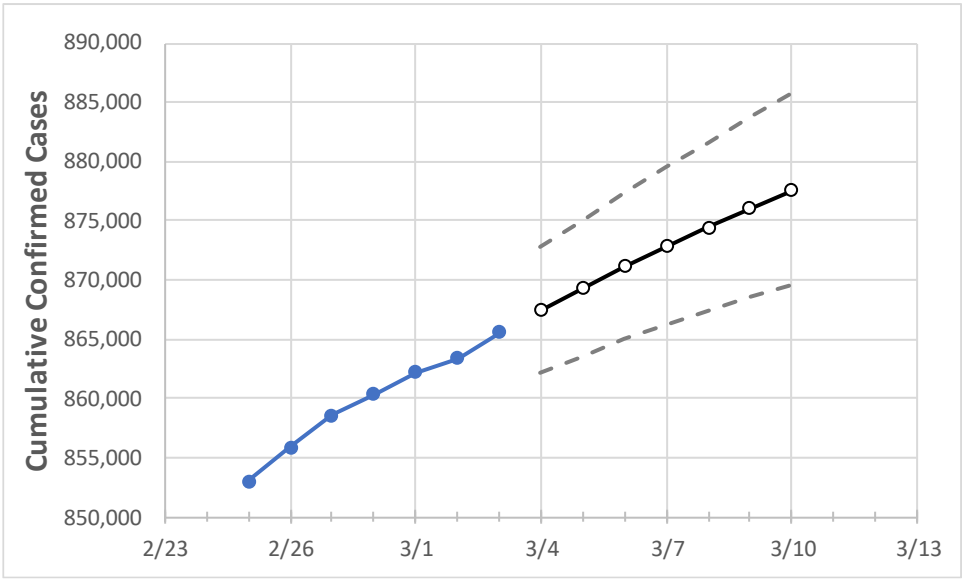
IEM's Modeling Lead

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:						
	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10
North Carolina	860,359	862,170	863,409	865,554	867,464	869,316	871,117	872,810	874,474	876,029	877,566

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:						
	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10
Cumberland	24,109	24,150	24,190	24,267	24,329	24,389	24,446	24,501	24,555	24,609	24,658
Durham	21,524	21,557	21,585	21,612	21,648	21,682	21,715	21,746	21,777	21,805	21,831
Guilford	39,853	39,936	40,024	40,105	40,186	40,264	40,340	40,411	40,479	40,545	40,612
Mecklenburg	96,813	97,073	97,203	97,409	97,617	97,818	98,009	98,197	98,380	98,555	98,720
Orange	7,723	7,743	7,753	7,767	7,782	7,797	7,811	7,824	7,836	7,848	7,859
Union	20,698	20,743	20,784	20,846	20,898	20,948	20,997	21,044	21,090	21,135	21,177
Wake	74,425	74,599	74,696	74,957	75,116	75,269	75,419	75,561	75,704	75,836	75,968

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:			
	2/28	3/1	3/2	3/3	3/5	3/7	3/9	
Cumberland	24,109	24,150	24,190	24,267	24,389 (4,878) [1,171] {585}	24,501 (4,900) [1,176] {588}	24,609 (4,922) [1,181] {591}	
Durham	21,524	21,557	21,585	21,612	21,682 (4,336) [1,041] {520}	21,746 (4,349) [1,044] {522}	21,805 (4,361) [1,047] {523}	
Guilford	39,853	39,936	40,024	40,105	40,264 (8,053) [1,933] {966}	40,411 (8,082) [1,940] {970}	40,545 (8,109) [1,946] {973}	
Mecklenburg	96,813	97,073	97,203	97,409	97,818 (19,564) [4,695] {2,348}	98,197 (19,639) [4,713] {2,357}	98,555 (19,711) [4,731] {2,365}	
Orange	7,723	7,743	7,753	7,767	7,797 (1,559) [374] {187}	7,824 (1,565) [376] {188}	7,848 (1,570) [377] {188}	
Union	20,698	20,743	20,784	20,846	20,948 (4,190) [1,006] {503}	21,044 (4,209) [1,010] {505}	21,135 (4,227) [1,014] {507}	
Wake	74,425	74,599	74,696	74,957	75,269 (15,054) [3,613] {1,806}	75,561 (15,112) [3,627] {1,813}	75,836 (15,167) [3,640] {1,820}	

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.