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

Date: 1/26/21

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 1/26/21 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.

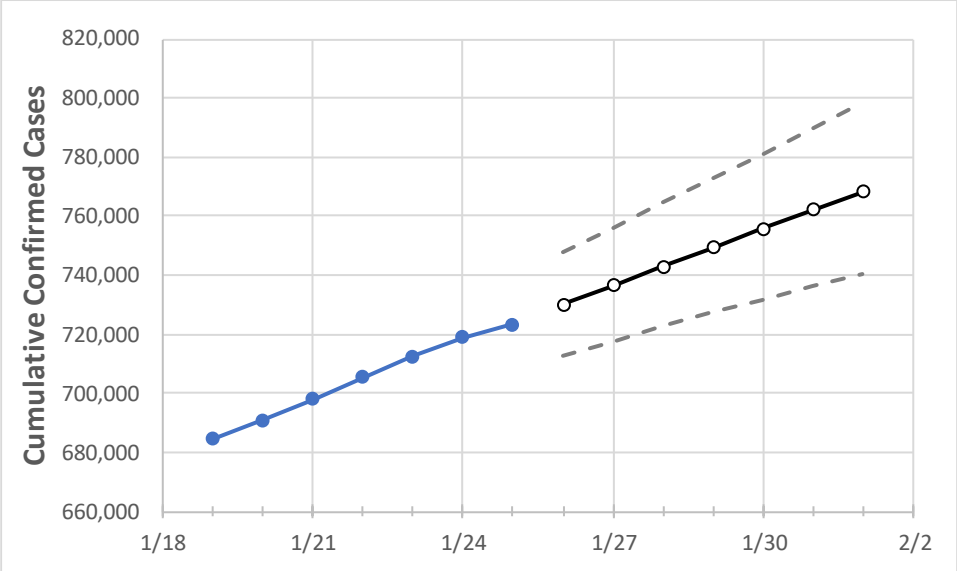
IEM's Modeling Lead

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:						
	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1
North Carolina	705,535	712,716	718,812	723,445	729,973	736,519	743,039	749,356	755,795	762,029	768,270

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:						
	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1
Cumberland	18,443	18,717	18,887	19,085	19,303	19,523	19,747	19,974	20,199	20,424	20,662
Durham	18,271	18,361	18,480	18,595	18,726	18,859	18,990	19,121	19,251	19,381	19,510
Guilford	32,386	32,749	33,119	33,373	33,701	34,027	34,350	34,673	35,002	35,326	35,648
Mecklenburg	80,241	81,137	81,875	82,572	83,344	84,108	84,878	85,658	86,428	87,220	88,008
Orange	6,282	6,334	6,380	6,420	6,468	6,516	6,563	6,612	6,660	6,707	6,756
Union	17,022	17,205	17,337	17,462	17,627	17,791	17,948	18,107	18,266	18,425	18,583
Wake	59,872	60,547	61,106	61,709	62,367	63,027	63,705	64,372	65,050	65,719	66,400

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:		
	1/22	1/23	1/24	1/25	1/27	1/29	1/31
Cumberland	18,443	18,717	18,887	19,085	19,523 (3,905) [937] {469}	19,974 (3,995) [959] {479}	20,424 (4,085) [980] {490}
Durham	18,271	18,361	18,480	18,595	18,859 (3,772) [905] {453}	19,121 (3,824) [918] {459}	19,381 (3,876) [930] {465}
Guilford	32,386	32,749	33,119	33,373	34,027 (6,805) [1,633] {817}	34,673 (6,935) [1,664] {832}	35,326 (7,065) [1,696] {848}
Mecklenburg	80,241	81,137	81,875	82,572	84,108 (16,822) [4,037] {2,019}	85,658 (17,132) [4,112] {2,056}	87,220 (17,444) [4,187] {2,093}
Orange	6,282	6,334	6,380	6,420	6,516 (1,303) [313] {156}	6,612 (1,322) [317] {159}	6,707 (1,341) [322] {161}
Union	17,022	17,205	17,337	17,462	17,791 (3,558) [854] {427}	18,107 (3,621) [869] {435}	18,425 (3,685) [884] {442}
Wake	59,872	60,547	61,106	61,709	63,027 (12,605) [3,025] {1,513}	64,372 (12,874) [3,090] {1,545}	65,719 (13,144) [3,154] {1,577}

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.