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

Date: 2/5/21

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 2/5/21 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.

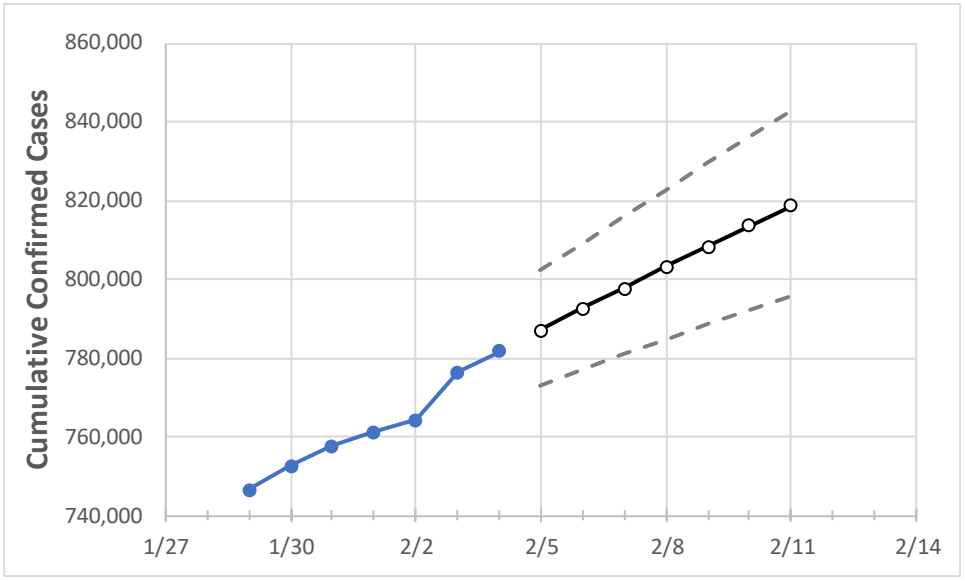
IEM's Modeling Lead

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:						
	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8	2/9	2/10	2/11
North Carolina	761,302	764,228	776,307	781,802	787,073	792,489	797,747	803,124	808,325	813,471	818,625

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:						
	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8	2/9	2/10	2/11
Cumberland	20,407	20,555	21,049	21,278	21,502	21,727	21,954	22,186	22,416	22,649	22,882
Durham	19,455	19,541	19,728	19,837	19,950	20,062	20,174	20,284	20,397	20,507	20,614
Guilford	35,206	35,355	36,020	36,238	36,524	36,807	37,085	37,361	37,640	37,920	38,192
Mecklenburg	86,860	87,233	88,055	88,564	89,123	89,680	90,233	90,773	91,322	91,841	92,366
Orange	6,823	6,848	6,949	6,992	7,046	7,099	7,152	7,206	7,260	7,314	7,370
Union	18,345	18,422	18,714	18,827	18,952	19,073	19,196	19,316	19,432	19,545	19,657
Wake	65,564	65,716	66,959	67,475	68,003	68,541	69,080	69,593	70,109	70,632	71,165

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:		
	2/1	2/2	2/3	2/4	2/6	2/8	2/10
Cumberland	20,407	20,555	21,049	21,278	21,727 (4,345) [1,043] {521}	22,186 (4,437) [1,065] {532}	22,649 (4,530) [1,087] {544}
Durham	19,455	19,541	19,728	19,837	20,062 (4,012) [963] {481}	20,284 (4,057) [974] {487}	20,507 (4,101) [984] {492}
Guilford	35,206	35,355	36,020	36,238	36,807 (7,361) [1,767] {883}	37,361 (7,472) [1,793] {897}	37,920 (7,584) [1,820] {910}
Mecklenburg	86,860	87,233	88,055	88,564	89,680 (17,936) [4,305] {2,152}	90,773 (18,155) [4,357] {2,179}	91,841 (18,368) [4,408] {2,204}
Orange	6,823	6,848	6,949	6,992	7,099 (1,420) [341] {170}	7,206 (1,441) [346] {173}	7,314 (1,463) [351] {176}
Union	18,345	18,422	18,714	18,827	19,073 (3,815) [916] {458}	19,316 (3,863) [927] {464}	19,545 (3,909) [938] {469}
Wake	65,564	65,716	66,959	67,475	68,541 (13,708) [3,290] {1,645}	69,593 (13,919) [3,340] {1,670}	70,632 (14,126) [3,390] {1,695}

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.