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

Date: 12/15/20

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 12/15/20 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.

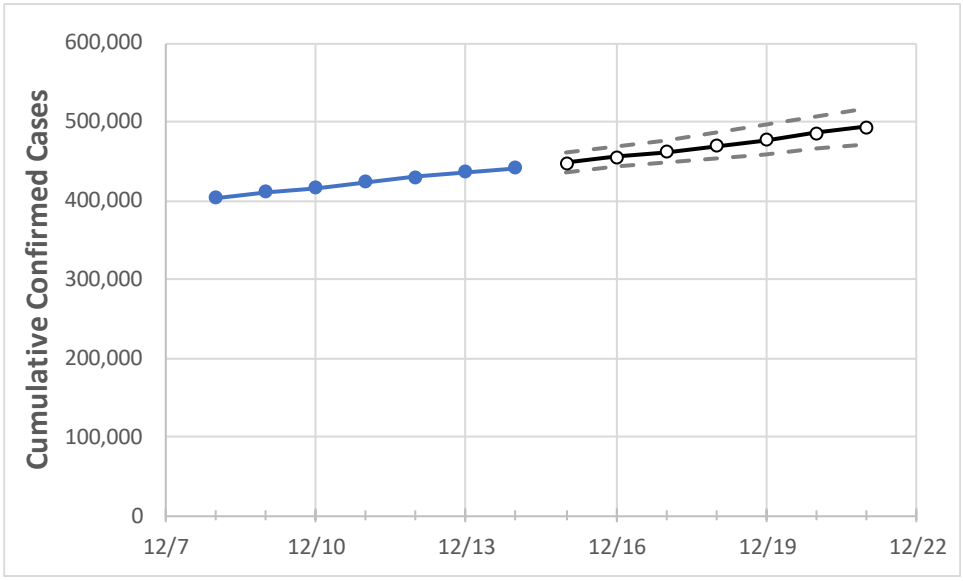
IEM's Modeling Lead

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:						
	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21
North Carolina	423,623	429,776	436,595	441,365	448,131	455,104	462,289	469,690	477,314	485,166	493,252

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 20%, and are often within 10%, of actual confirmed cases.

North Carolina Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21
Cumberland	10,882	11,025	11,193	11,331	11,492	11,658	11,830	12,006	12,188	12,376	12,569
Durham	12,416	12,598	12,767	12,854	12,996	13,144	13,298	13,457	13,623	13,794	13,972
Guilford	19,595	19,848	20,129	20,364	20,662	20,967	21,279	21,597	21,924	22,257	22,598
Mecklenburg	49,955	50,535	51,290	51,896	52,623	53,372	54,146	54,943	55,766	56,614	57,489
Orange	4,316	4,363	4,405	4,443	4,487	4,532	4,578	4,625	4,674	4,723	4,774
Union	9,348	9,492	9,645	9,783	9,958	10,139	10,327	10,522	10,725	10,935	11,153
Wake	33,744	34,423	35,029	35,343	35,916	36,507	37,117	37,746	38,395	39,064	39,754

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:		
	12/11	12/12	12/13	12/14	12/16	12/18	12/20
Cumberland	10,882	11,025	11,193	11,331	11,658 (2,332) [560] {280}	12,006 (2,401) [576] {288}	12,376 (2,475) [594] {297}
Durham	12,416	12,598	12,767	12,854	13,144 (2,629) [631] {315}	13,457 (2,691) [646] {323}	13,794 (2,759) [662] {331}
Guilford	19,595	19,848	20,129	20,364	20,967 (4,193) [1,006] {503}	21,597 (4,319) [1,037] {518}	22,257 (4,451) [1,068] {534}
Mecklenburg	49,955	50,535	51,290	51,896	53,372 (10,674) [2,562] {1,281}	54,943 (10,989) [2,637] {1,319}	56,614 (11,323) [2,717] {1,359}
Orange	4,316	4,363	4,405	4,443	4,532 (906) [218] {109}	4,625 (925) [222] {111}	4,723 (945) [227] {113}
Union	9,348	9,492	9,645	9,783	10,139 (2,028) [487] {243}	10,522 (2,104) [505] {253}	10,935 (2,187) [525] {262}
Wake	33,744	34,423	35,029	35,343	36,507 (7,301) [1,752] {876}	37,746 (7,549) [1,812] {906}	39,064 (7,813) [1,875] {938}

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.