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

Date: 2/11/22

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 2/11/22 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.

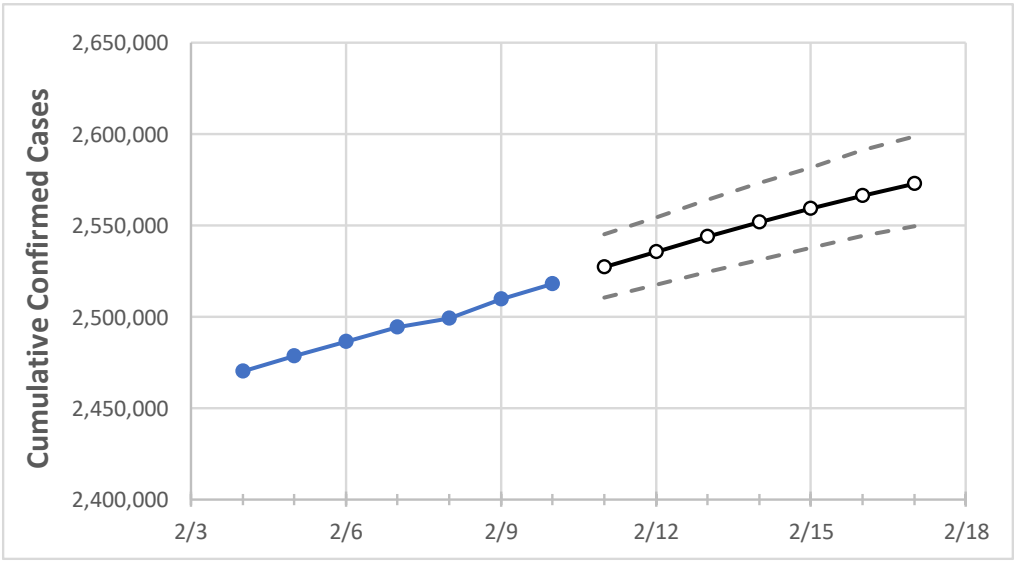
IEM's Modeling Lead

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:						
	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17
North Carolina	2,494,309	2,498,957	2,509,470	2,518,195	2,527,153	2,535,588	2,543,795	2,551,602	2,559,083	2,566,320	2,573,061

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:						
	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17
Cumberland	78,446	78,724	79,030	79,272	79,766	80,258	80,737	81,179	81,658	82,131	82,541
Durham	66,227	66,359	66,686	66,902	67,126	67,327	67,521	67,712	67,893	68,066	68,237
Guilford	110,512	110,680	110,987	111,250	111,535	111,810	112,066	112,312	112,541	112,772	112,990
Mecklenburg	267,001	267,384	268,164	268,913	269,580	270,236	270,839	271,427	272,009	272,544	273,082
Orange	24,138	24,259	24,374	24,520	24,654	24,788	24,913	25,033	25,156	25,274	25,388
Union	59,101	59,170	59,399	59,575	59,745	59,913	60,070	60,226	60,374	60,510	60,649
Wake	274,956	275,360	276,754	277,817	278,782	279,745	280,613	281,454	282,276	283,066	283,808

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:			
	2/7	2/8	2/9	2/10	2/12	2/14	2/16	
Cumberland	78,446	78,724	79,030	79,272	80,258 (16,052) [3,852] {1,926}	81,179 (16,236) [3,897] {1,948}	82,131 (16,426) [3,942] {1,971}	
Durham	66,227	66,359	66,686	66,902	67,327 (13,465) [3,232] {1,616}	67,712 (13,542) [3,250] {1,625}	68,066 (13,613) [3,267] {1,634}	
Guilford	110,512	110,680	110,987	111,250	111,810 (22,362) [5,367] {2,683}	112,312 (22,462) [5,391] {2,695}	112,772 (22,554) [5,413] {2,707}	
Mecklenburg	267,001	267,384	268,164	268,913	270,236 (54,047) [12,971] {6,486}	271,427 (54,285) [13,028] {6,514}	272,544 (54,509) [13,082] {6,541}	
Orange	24,138	24,259	24,374	24,520	24,788 (4,958) [1,190] {595}	25,033 (5,007) [1,202] {601}	25,274 (5,055) [1,213] {607}	
Union	59,101	59,170	59,399	59,575	59,913 (11,983) [2,876] {1,438}	60,226 (12,045) [2,891] {1,445}	60,510 (12,102) [2,904] {1,452}	
Wake	274,956	275,360	276,754	277,817	279,745 (55,949) [13,428] {6,714}	281,454 (56,291) [13,510] {6,755}	283,066 (56,613) [13,587] {6,794}	

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.