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

Date: 3/16/21

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 3/16/21 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.

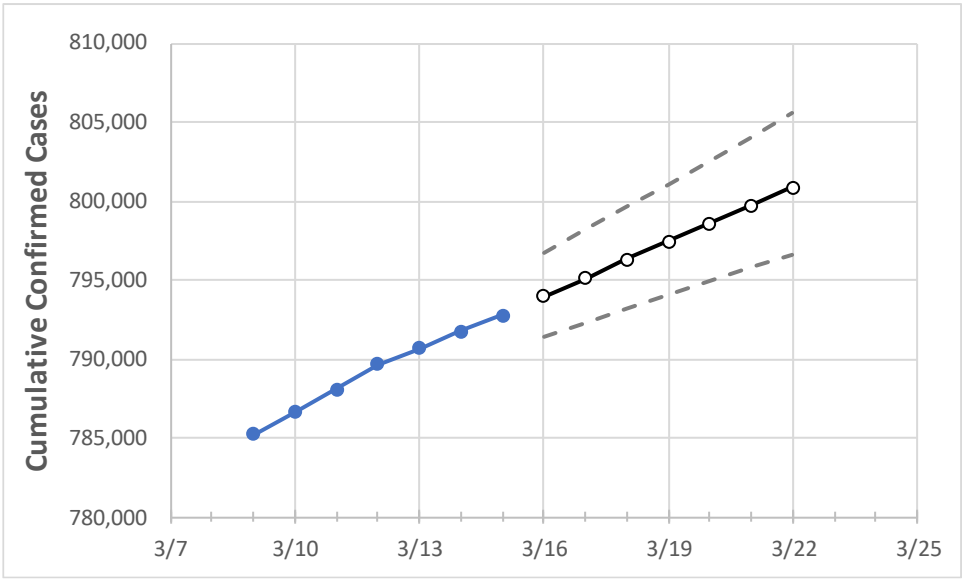
IEM's Modeling Lead

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.

Tennessee State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	3/12	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22
Tennessee	789,652	790,700	791,747	792,795	793,978	795,126	796,286	797,462	798,605	799,735	800,872

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.

Tennessee Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	3/12	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22
Blount	14,334	14,351	14,367	14,384	14,404	14,424	14,443	14,462	14,480	14,499	14,517
Davidson	82,932	83,062	83,191	83,321	83,445	83,570	83,692	83,815	83,938	84,057	84,177
Hamilton	41,129	41,186	41,244	41,301	41,357	41,412	41,468	41,521	41,576	41,628	41,678
Knox	46,940	46,999	47,057	47,116	47,181	47,245	47,307	47,367	47,427	47,485	47,541
Rutherford	39,274	39,359	39,444	39,529	39,614	39,700	39,787	39,874	39,960	40,048	40,135
Shelby	88,505	88,605	88,704	88,804	88,897	88,986	89,070	89,158	89,240	89,321	89,406
Sumner	21,786	21,819	21,851	21,884	21,919	21,952	21,987	22,020	22,053	22,086	22,119
Williamson	25,735	25,779	25,823	25,867	25,904	25,939	25,975	26,010	26,044	26,077	26,110

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.*

Tennessee Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	3/12	3/13	3/14	3/15	3/17	3/19	3/21
Blount	14,334	14,351	14,367	14,384	14,424 (2,885) [692] {346}	14,462 (2,892) [694] {347}	14,499 (2,900) [696] {348}
Davidson	82,932	83,062	83,191	83,321	83,570 (16,714) [4,011] {2,006}	83,815 (16,763) [4,023] {2,012}	84,057 (16,811) [4,035] {2,017}
Hamilton	41,129	41,186	41,244	41,301	41,412 (8,282) [1,988] {994}	41,521 (8,304) [1,993] {997}	41,628 (8,326) [1,998] {999}
Knox	46,940	46,999	47,057	47,116	47,245 (9,449) [2,268] {1,134}	47,367 (9,473) [2,274] {1,137}	47,485 (9,497) [2,279] {1,140}
Rutherford	39,274	39,359	39,444	39,529	39,700 (7,940) [1,906] {953}	39,874 (7,975) [1,914] {957}	40,048 (8,010) [1,922] {961}
Shelby	88,505	88,605	88,704	88,804	88,986 (17,797) [4,271] {2,136}	89,158 (17,832) [4,280] {2,140}	89,321 (17,864) [4,287] {2,144}
Sumner	21,786	21,819	21,851	21,884	21,952 (4,390) [1,054] {527}	22,020 (4,404) [1,057] {528}	22,086 (4,417) [1,060] {530}
Williamson	25,735	25,779	25,823	25,867	25,939 (5,188) [1,245] {623}	26,010 (5,202) [1,248] {624}	26,077 (5,215) [1,252] {626}

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.