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

Date: 3/2/21

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 3/2/21 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.

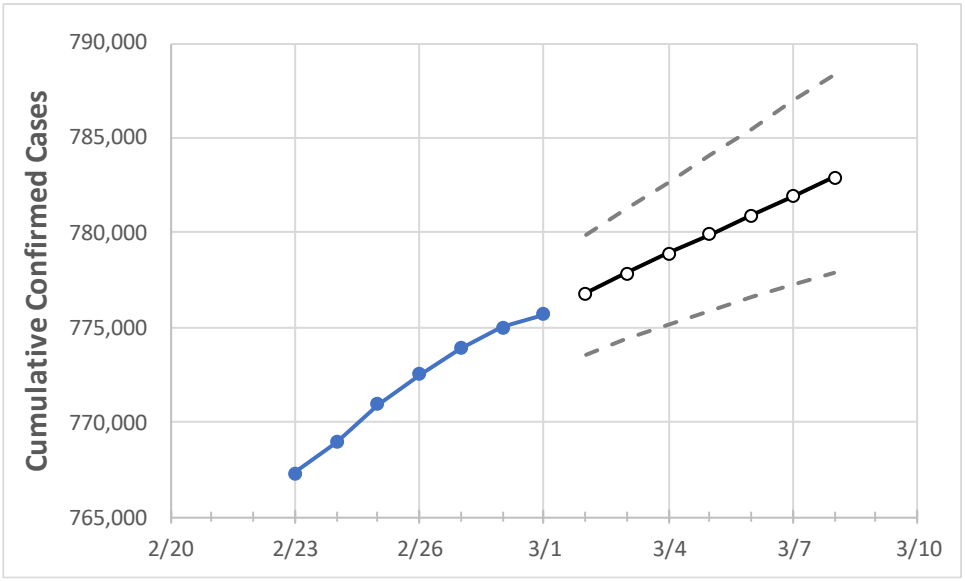
IEM's Modeling Lead

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:						
	2/26	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8
Tennessee	772,513	773,887	775,004	775,693	776,773	777,842	778,890	779,918	780,920	781,899	782,905

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:						
	2/26	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8
Blount	13,990	14,017	14,036	14,050	14,065	14,080	14,094	14,107	14,119	14,131	14,143
Davidson	81,174	81,291	81,420	81,463	81,549	81,628	81,706	81,780	81,845	81,911	81,978
Hamilton	40,180	40,255	40,298	40,359	40,432	40,501	40,568	40,635	40,699	40,760	40,820
Knox	45,487	45,728	45,877	45,959	46,066	46,170	46,275	46,380	46,479	46,575	46,670
Rutherford	38,104	38,186	38,301	38,346	38,408	38,469	38,525	38,581	38,633	38,688	38,736
Shelby	86,958	87,084	87,219	87,261	87,353	87,437	87,520	87,599	87,672	87,742	87,806
Sumner	21,260	21,290	21,329	21,354	21,385	21,415	21,444	21,473	21,503	21,531	21,558
Williamson	25,145	25,198	25,238	25,267	25,302	25,336	25,368	25,399	25,429	25,457	25,484

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:		
	2/26	2/27	2/28	3/1	3/3	3/5	3/7
Blount	13,990	14,017	14,036	14,050	14,080 (2,816) [676] {338}	14,107 (2,821) [677] {339}	14,131 (2,826) [678] {339}
Davidson	81,174	81,291	81,420	81,463	81,628 (16,326) [3,918] {1,959}	81,780 (16,356) [3,925] {1,963}	81,911 (16,382) [3,932] {1,966}
Hamilton	40,180	40,255	40,298	40,359	40,501 (8,100) [1,944] {972}	40,635 (8,127) [1,950] {975}	40,760 (8,152) [1,956] {978}
Knox	45,487	45,728	45,877	45,959	46,170 (9,234) [2,216] {1,108}	46,380 (9,276) [2,226] {1,113}	46,575 (9,315) [2,236] {1,118}
Rutherford	38,104	38,186	38,301	38,346	38,469 (7,694) [1,846] {923}	38,581 (7,716) [1,852] {926}	38,688 (7,738) [1,857] {929}
Shelby	86,958	87,084	87,219	87,261	87,437 (17,487) [4,197] {2,098}	87,599 (17,520) [4,205] {2,102}	87,742 (17,548) [4,212] {2,106}
Sumner	21,260	21,290	21,329	21,354	21,415 (4,283) [1,028] {514}	21,473 (4,295) [1,031] {515}	21,531 (4,306) [1,033] {517}
Williamson	25,145	25,198	25,238	25,267	25,336 (5,067) [1,216] {608}	25,399 (5,080) [1,219] {610}	25,457 (5,091) [1,222] {611}

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.