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

Date: 4/6/21

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 4/6/21 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.

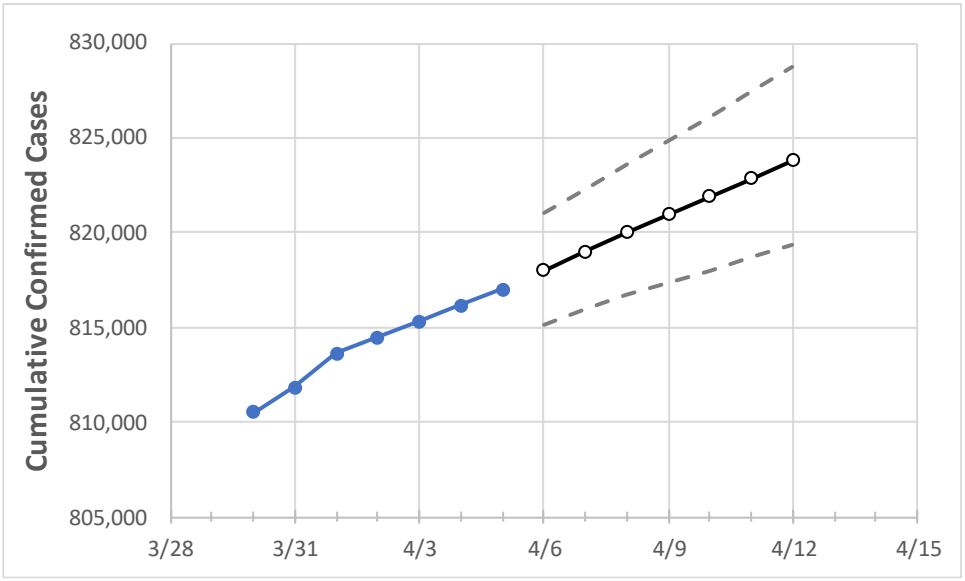
IEM's Modeling Lead

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:						
	4/2	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12
Tennessee	814,466	815,318	816,170	817,022	818,017	819,019	820,001	820,981	821,931	822,858	823,807

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:						
	4/2	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12
Blount	14,728	14,740	14,751	14,762	14,774	14,786	14,797	14,809	14,819	14,829	14,839
Davidson	85,771	85,870	85,969	86,068	86,181	86,291	86,404	86,514	86,624	86,731	86,837
Hamilton	42,462	42,501	42,539	42,577	42,625	42,673	42,720	42,766	42,811	42,855	42,898
Knox	48,509	48,577	48,644	48,711	48,778	48,843	48,908	48,970	49,034	49,097	49,159
Rutherford	40,983	41,042	41,101	41,160	41,226	41,292	41,357	41,421	41,484	41,546	41,606
Shelby	90,735	90,818	90,900	90,982	91,081	91,181	91,279	91,376	91,473	91,570	91,665
Sumner	22,631	22,668	22,705	22,742	22,781	22,821	22,859	22,897	22,934	22,971	23,009
Williamson	26,699	26,729	26,760	26,790	26,829	26,868	26,906	26,945	26,982	27,018	27,054

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:		
	4/2	4/3	4/4	4/5	4/7	4/9	4/11
Blount	14,728	14,740	14,751	14,762	14,786 (2,957) [710] {355}	14,809 (2,962) [711] {355}	14,829 (2,966) [712] {356}
Davidson	85,771	85,870	85,969	86,068	86,291 (17,258) [4,142] {2,071}	86,514 (17,303) [4,153] {2,076}	86,731 (17,346) [4,163] {2,082}
Hamilton	42,462	42,501	42,539	42,577	42,673 (8,535) [2,048] {1,024}	42,766 (8,553) [2,053] {1,026}	42,855 (8,571) [2,057] {1,029}
Knox	48,509	48,577	48,644	48,711	48,843 (9,769) [2,344] {1,172}	48,970 (9,794) [2,351] {1,175}	49,097 (9,819) [2,357] {1,178}
Rutherford	40,983	41,042	41,101	41,160	41,292 (8,258) [1,982] {991}	41,421 (8,284) [1,988] {994}	41,546 (8,309) [1,994] {997}
Shelby	90,735	90,818	90,900	90,982	91,181 (18,236) [4,377] {2,188}	91,376 (18,275) [4,386] {2,193}	91,570 (18,314) [4,395] {2,198}
Sumner	22,631	22,668	22,705	22,742	22,821 (4,564) [1,095] {548}	22,897 (4,579) [1,099] {550}	22,971 (4,594) [1,103] {551}
Williamson	26,699	26,729	26,760	26,790	26,868 (5,374) [1,290] {645}	26,945 (5,389) [1,293] {647}	27,018 (5,404) [1,297] {648}

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.