IEM's AI Modeling: Short-term COVID-19 Projections
Date: 6/14/21

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 <u>not</u> 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 6/14/21 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.
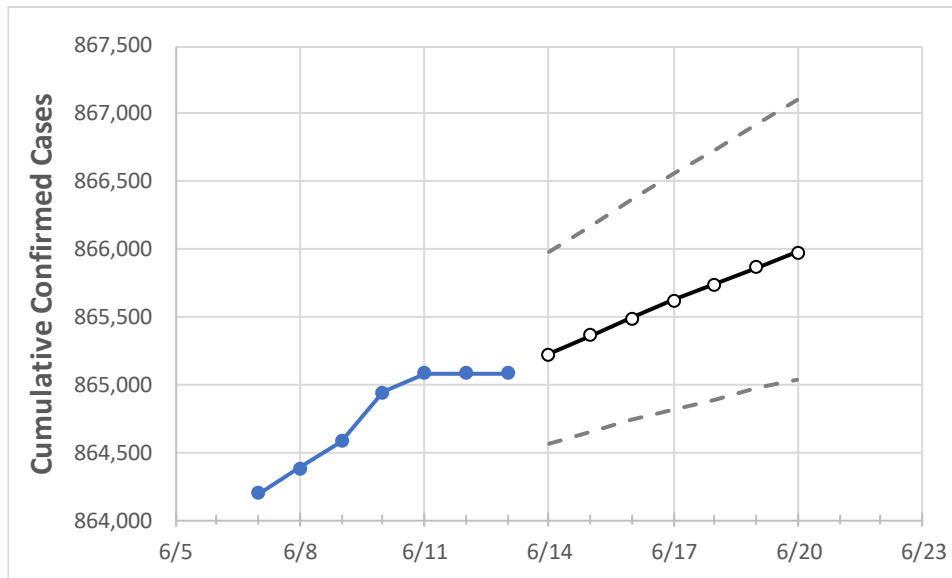
IEM's Modeling Lead
Dr. Prasith "Sid" Baccam is a **Computational Epidemiologist expert** at IEM with more than **20 years of experience in medical consequence modeling and simulation of disease outbreaks** and medical consequences following hypothetical attacks with biological agents or emerging infectious 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:						
	6/10	6/11	6/12	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20
Tennessee	864,945	865,085	865,085	865,085	865,227	865,362	865,489	865,623	865,742	865,864	865,979

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:						
	6/10	6/11	6/12	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20
Blount	15,646	15,813	15,813	15,813	15,906	16,016	16,148	16,305	16,494	16,721	16,988
Davidson	90,320	90,563	90,563	90,563	90,629	90,700	90,776	90,860	90,948	91,044	91,148
Hamilton	45,134	45,165	45,165	45,165	45,175	45,185	45,194	45,202	45,211	45,219	45,227
Knox	51,764	51,983	51,983	51,983	52,068	52,154	52,244	52,340	52,437	52,533	52,637
Rutherford	43,552	43,601	43,601	43,601	43,612	43,624	43,635	43,647	43,659	43,670	43,682
Shelby	98,004	98,137	98,137	98,137	98,179	98,220	98,262	98,304	98,346	98,388	98,430
Sumner	24,397	24,449	24,449	24,449	24,465	24,482	24,500	24,518	24,536	24,554	24,573
Williamson	28,473	28,595	28,595	28,595	28,647	28,701	28,758	28,824	28,891	28,964	29,044

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: | | |
	6/10	6/11	6/12	6/13	6/15	6/17	6/19
Blount	15,646	15,813	15,813	15,813	16,016 (3,203) [769] {384}	16,305 (3,261) [783] {391}	16,721 (3,344) [803] {401}
Davidson	90,320	90,563	90,563	90,563	90,700 (18,140) [4,354] {2,177}	90,860 (18,172) [4,361] {2,181}	91,044 (18,209) [4,370] {2,185}
Hamilton	45,134	45,165	45,165	45,165	45,185 (9,037) [2,169] {1,084}	45,202 (9,040) [2,170] {1,085}	45,219 (9,044) [2,171] {1,085}
Knox	51,764	51,983	51,983	51,983	52,154 (10,431) [2,503] {1,252}	52,340 (10,468) [2,512] {1,256}	52,533 (10,507) [2,522] {1,261}
Rutherford	43,552	43,601	43,601	43,601	43,624 (8,725) [2,094] {1,047}	43,647 (8,729) [2,095] {1,048}	43,670 (8,734) [2,096] {1,048}
Shelby	98,004	98,137	98,137	98,137	98,220 (19,644) [4,715] {2,357}	98,304 (19,661) [4,719] {2,359}	98,388 (19,678) [4,723] {2,361}
Sumner	24,397	24,449	24,449	24,449	24,482 (4,896) [1,175] {588}	24,518 (4,904) [1,177] {588}	24,554 (4,911) [1,179] {589}
Williamson	28,473	28,595	28,595	28,595	28,701 (5,740) [1,378] {689}	28,824 (5,765) [1,384] {692}	28,964 (5,793) [1,390] {695}

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.