IEM's AI Modeling: Short-term COVID-19 Projections
Date: 9/10/21

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 9/10/21 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
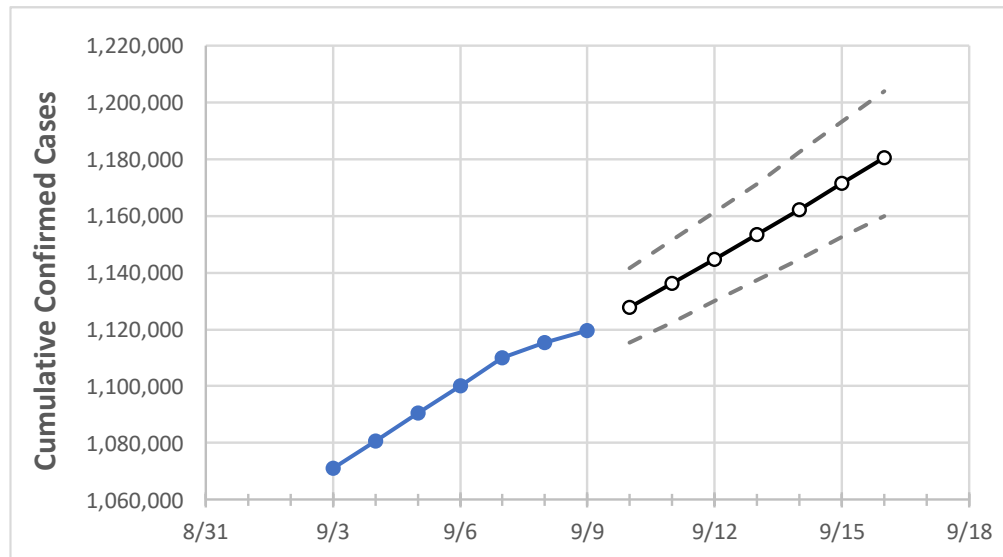
	Actual Confirmed Cases On:				Projected Cases For:						
	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16
Tennessee	1,100,224	1,109,923	1,115,345	1,119,545	1,127,868	1,136,264	1,144,742	1,153,504	1,162,125	1,171,341	1,180,451

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:						
	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16
Blount	19,855	20,029	20,112	20,211	20,361	20,514	20,670	20,828	20,992	21,158	21,326
Davidson	107,380	108,017	108,331	108,699	109,232	109,803	110,357	110,923	111,480	112,084	112,658
Hamilton	55,983	56,336	56,607	56,810	57,143	57,485	57,823	58,166	58,517	58,875	59,237
Knox	65,117	65,813	66,217	66,501	67,121	67,747	68,391	69,056	69,717	70,415	71,134
Rutherford	54,011	54,545	54,731	54,973	55,405	55,847	56,279	56,731	57,200	57,666	58,149
Shelby	129,081	129,948	130,495	130,939	131,661	132,362	133,062	133,769	134,480	135,211	135,921
Sumner	30,629	30,827	30,897	31,021	31,202	31,374	31,544	31,721	31,900	32,079	32,252
Williamson	35,147	35,375	35,547	35,681	35,890	36,095	36,307	36,521	36,736	36,955	37,177

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:		
	9/6	9/7	9/8	9/9	9/11	9/13	9/15
Blount	19,855	20,029	20,112	20,211	20,514 (4,103) [985] {492}	20,828 (4,166) [1,000] {500}	21,158 (4,232) [1,016] {508}
Davidson	107,380	108,017	108,331	108,699	109,803 (21,961) [5,271] {2,635}	110,923 (22,185) [5,324] {2,662}	112,084 (22,417) [5,380] {2,690}
Hamilton	55,983	56,336	56,607	56,810	57,485 (11,497) [2,759] {1,380}	58,166 (11,633) [2,792] {1,396}	58,875 (11,775) [2,826] {1,413}
Knox	65,117	65,813	66,217	66,501	67,747 (13,549) [3,252] {1,626}	69,056 (13,811) [3,315] {1,657}	70,415 (14,083) [3,380] {1,690}
Rutherford	54,011	54,545	54,731	54,973	55,847 (11,169) [2,681] {1,340}	56,731 (11,346) [2,723] {1,362}	57,666 (11,533) [2,768] {1,384}
Shelby	129,081	129,948	130,495	130,939	132,362 (26,472) [6,353] {3,177}	133,769 (26,754) [6,421] {3,210}	135,211 (27,042) [6,490] {3,245}
Sumner	30,629	30,827	30,897	31,021	31,374 (6,275) [1,506] {753}	31,721 (6,344) [1,523] {761}	32,079 (6,416) [1,540] {770}
Williamson	35,147	35,375	35,547	35,681	36,095 (7,219) [1,733] {866}	36,521 (7,304) [1,753] {877}	36,955 (7,391) [1,774] {887}

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.