IEM's AI Modeling: Short-term COVID-19 Projections
Date: 7/21/21

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 7/21/21 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.

Mississippi State Projections
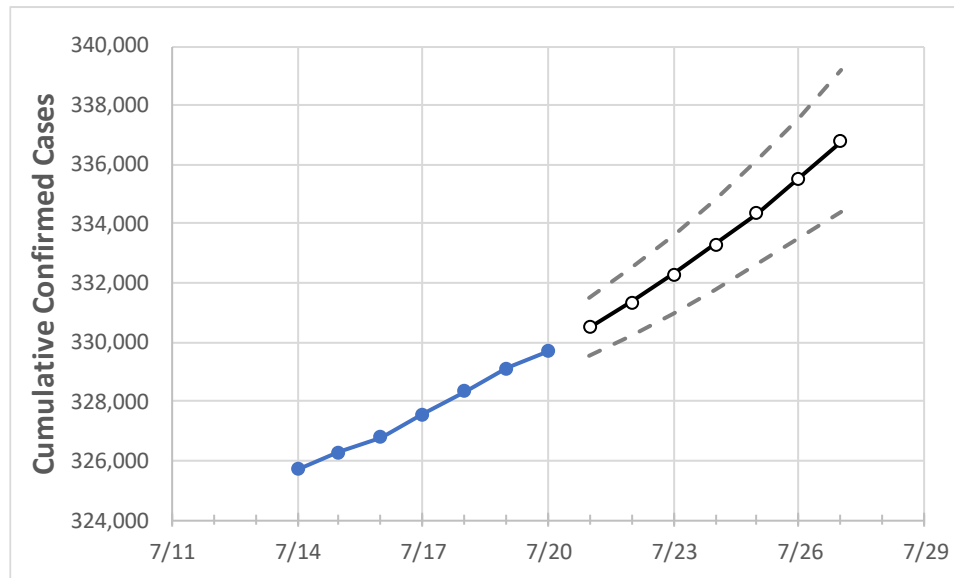
	Actual Confirmed Cases On:				Projected Cases For:						
	7/17	7/18	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27
Mississippi	327,579	328,355	329,130	329,703	330,499	331,364	332,291	333,293	334,368	335,530	336,772

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.

Mississippi Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	7/17	7/18	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27
DeSoto	22,667	22,700	22,732	22,766	22,802	22,842	22,885	22,931	22,980	23,032	23,089
Harrison	19,066	19,144	19,221	19,268	19,345	19,426	19,516	19,615	19,720	19,835	19,961
Hinds	22,064	22,193	22,322	22,385	22,521	22,665	22,821	22,986	23,165	23,357	23,558
Jackson	14,020	14,049	14,077	14,098	14,124	14,152	14,182	14,214	14,247	14,284	14,324
Lauderdale	7,372	7,402	7,432	7,445	7,473	7,508	7,547	7,591	7,643	7,702	7,773
Madison	10,524	10,550	10,576	10,589	10,615	10,642	10,671	10,703	10,736	10,771	10,809
Rankin	14,494	14,546	14,598	14,631	14,685	14,743	14,804	14,870	14,941	15,016	15,095

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.*

Mississippi Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	7/17	7/18	7/19	7/20	7/22	7/24	7/26
DeSoto	22,667	22,700	22,732	22,766	22,842 (4,568) [1,096] {548}	22,931 (4,586) [1,101] {550}	23,032 (4,606) [1,106] {553}
Harrison	19,066	19,144	19,221	19,268	19,426 (3,885) [932] {466}	19,615 (3,923) [942] {471}	19,835 (3,967) [952] {476}
Hinds	22,064	22,193	22,322	22,385	22,665 (4,533) [1,088] {544}	22,986 (4,597) [1,103] {552}	23,357 (4,671) [1,121] {561}
Jackson	14,020	14,049	14,077	14,098	14,152 (2,830) [679] {340}	14,214 (2,843) [682] {341}	14,284 (2,857) [686] {343}
Lauderdale	7,372	7,402	7,432	7,445	7,508 (1,502) [360] {180}	7,591 (1,518) [364] {182}	7,702 (1,540) [370] {185}
Madison	10,524	10,550	10,576	10,589	10,642 (2,128) [511] {255}	10,703 (2,141) [514] {257}	10,771 (2,154) [517] {259}
Rankin	14,494	14,546	14,598	14,631	14,743 (2,949) [708] {354}	14,870 (2,974) [714] {357}	15,016 (3,003) [721] {360}

For additional information from IEM, please contact Jon Mabry, Vice President of Disaster Recovery at 601-953-4562 or jon.mabry@iem.com or Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966.