IEM's AI Modeling: Short-term COVID-19 Projections
Date: 9/13/21

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 9/13/21 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
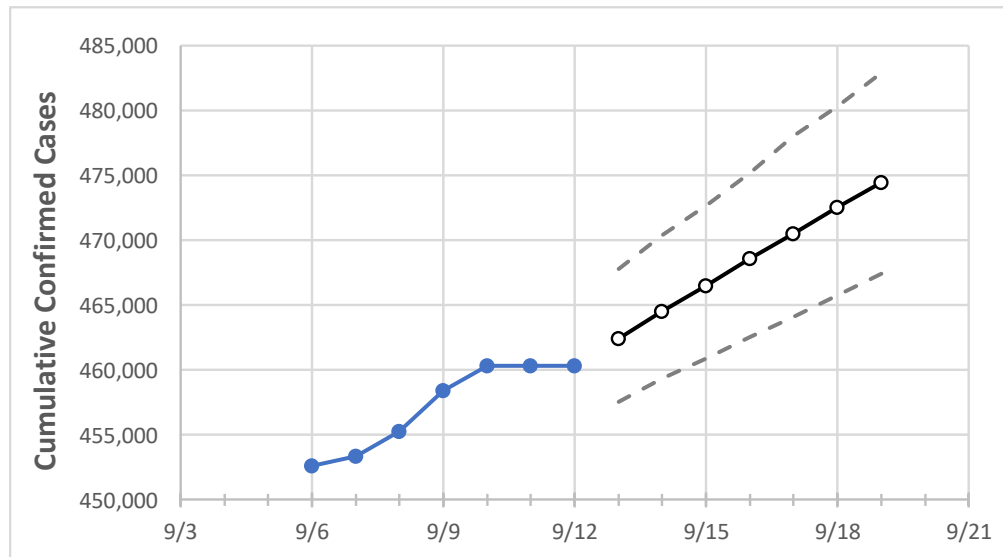
	Actual Confirmed Cases On:				Projected Cases For:						
	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16	9/17	9/18	9/19
Mississippi	458,420	460,312	460,312	460,312	462,423	464,495	466,511	468,558	470,511	472,541	474,431

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:						
	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16	9/17	9/18	9/19
DeSoto	28,734	28,890	28,890	28,890	29,039	29,193	29,347	29,505	29,652	29,812	29,965
Harrison	31,179	31,264	31,264	31,264	31,410	31,560	31,690	31,831	31,958	32,096	32,224
Hinds	30,110	30,194	30,194	30,194	30,291	30,390	30,482	30,576	30,672	30,755	30,849
Jackson	22,341	22,439	22,439	22,439	22,543	22,647	22,752	22,850	22,949	23,042	23,136
Lauderdale	11,042	11,090	11,090	11,090	11,133	11,174	11,219	11,256	11,299	11,338	11,376
Madison	13,756	13,807	13,807	13,807	13,863	13,918	13,969	14,024	14,077	14,131	14,184
Rankin	20,738	20,794	20,794	20,794	20,875	20,954	21,030	21,105	21,180	21,257	21,330

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:		
	9/9	9/10	9/11	9/12	9/14	9/16	9/18
DeSoto	28,734	28,890	28,890	28,890	29,193 (5,839) [1,401] {701}	29,505 (5,901) [1,416] {708}	29,812 (5,962) [1,431] {715}
Harrison	31,179	31,264	31,264	31,264	31,560 (6,312) [1,515] {757}	31,831 (6,366) [1,528] {764}	32,096 (6,419) [1,541] {770}
Hinds	30,110	30,194	30,194	30,194	30,390 (6,078) [1,459] {729}	30,576 (6,115) [1,468] {734}	30,755 (6,151) [1,476] {738}
Jackson	22,341	22,439	22,439	22,439	22,647 (4,529) [1,087] {544}	22,850 (4,570) [1,097] {548}	23,042 (4,608) [1,106] {553}
Lauderdale	11,042	11,090	11,090	11,090	11,174 (2,235) [536] {268}	11,256 (2,251) [540] {270}	11,338 (2,268) [544] {272}
Madison	13,756	13,807	13,807	13,807	13,918 (2,784) [668] {334}	14,024 (2,805) [673] {337}	14,131 (2,826) [678] {339}
Rankin	20,738	20,794	20,794	20,794	20,954 (4,191) [1,006] {503}	21,105 (4,221) [1,013] {507}	21,257 (4,251) [1,020] {510}

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.