IEM's AI Modeling: Short-term COVID-19 Projections
Date: 4/13/21

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 4/13/21 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
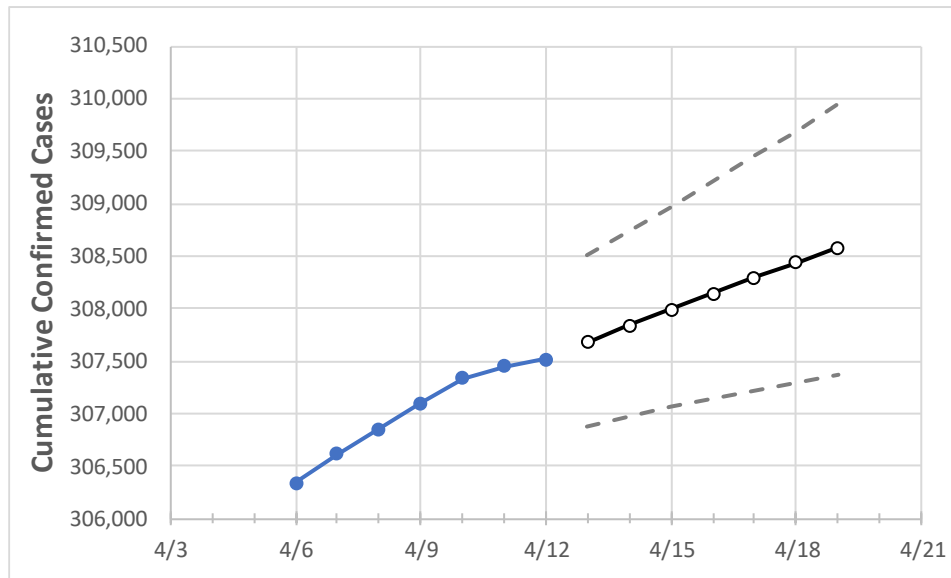
	Actual Confirmed Cases On:				Projected Cases For:						
	4/9	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19
Mississippi	307,094	307,332	307,449	307,519	307,677	307,836	307,993	308,146	308,294	308,441	308,583

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:						
	4/9	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19
DeSoto	20,729	20,757	20,772	20,784	20,802	20,820	20,837	20,854	20,870	20,886	20,901
Harrison	17,465	17,475	17,489	17,493	17,503	17,512	17,521	17,530	17,538	17,547	17,555
Hinds	19,851	19,869	19,888	19,894	19,909	19,923	19,937	19,951	19,965	19,978	19,992
Jackson	13,090	13,095	13,097	13,099	13,103	13,108	13,112	13,116	13,120	13,124	13,128
Lauderdale	7,170	7,185	7,187	7,189	7,199	7,209	7,219	7,229	7,240	7,251	7,261
Madison	9,876	9,886	9,895	9,896	9,901	9,906	9,911	9,916	9,921	9,926	9,930
Rankin	13,297	13,307	13,311	13,316	13,322	13,329	13,335	13,341	13,346	13,352	13,358

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:		
	4/9	4/10	4/11	4/12	4/14	4/16	4/18
DeSoto	20,729	20,757	20,772	20,784	20,820 (4,164) [999] {500}	20,854 (4,171) [1,001] {500}	20,886 (4,177) [1,003] {501}
Harrison	17,465	17,475	17,489	17,493	17,512 (3,502) [841] {420}	17,530 (3,506) [841] {421}	17,547 (3,509) [842] {421}
Hinds	19,851	19,869	19,888	19,894	19,923 (3,985) [956] {478}	19,951 (3,990) [958] {479}	19,978 (3,996) [959] {479}
Jackson	13,090	13,095	13,097	13,099	13,108 (2,622) [629] {315}	13,116 (2,623) [630] {315}	13,124 (2,625) [630] {315}
Lauderdale	7,170	7,185	7,187	7,189	7,209 (1,442) [346] {173}	7,229 (1,446) [347] {173}	7,251 (1,450) [348] {174}
Madison	9,876	9,886	9,895	9,896	9,906 (1,981) [475] {238}	9,916 (1,983) [476] {238}	9,926 (1,985) [476] {238}
Rankin	13,297	13,307	13,311	13,316	13,329 (2,666) [640] {320}	13,341 (2,668) [640] {320}	13,352 (2,670) [641] {320}

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.