IEM's AI Modeling: Short-term COVID-19 Projections
Date: 12/6/21

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 12/6/21 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
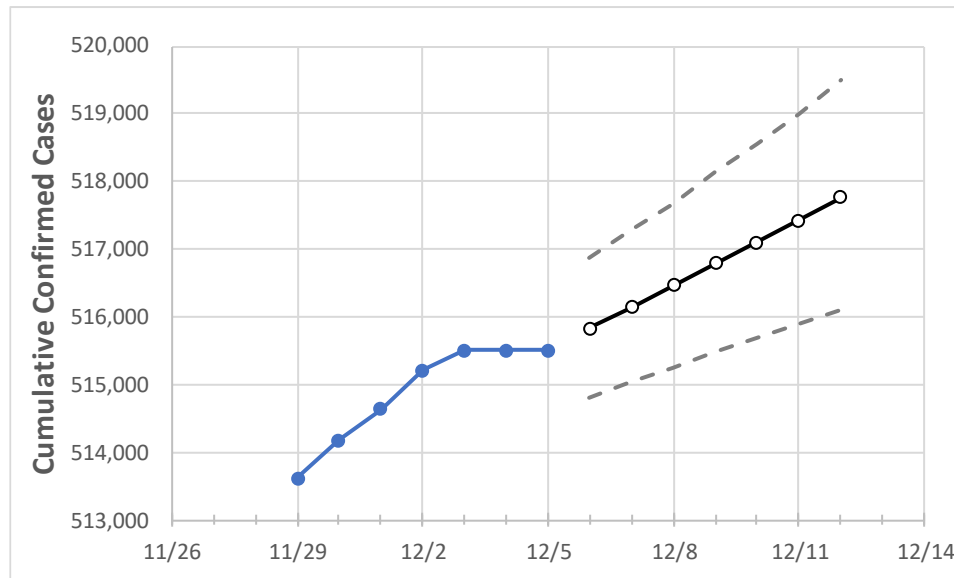
	Actual Confirmed Cases On:				Projected Cases For:						
	12/2	12/3	12/4	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12
Mississippi	515,208	515,504	515,504	515,504	515,824	516,140	516,468	516,790	517,105	517,428	517,762

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:						
	12/2	12/3	12/4	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12
DeSoto	33,342	33,360	33,360	33,360	33,378	33,396	33,413	33,430	33,448	33,465	33,482
Harrison	34,981	34,999	34,999	34,999	35,016	35,035	35,052	35,070	35,088	35,107	35,125
Hinds	32,718	32,743	32,743	32,743	32,764	32,785	32,807	32,829	32,852	32,875	32,899
Jackson	24,896	24,906	24,906	24,906	24,914	24,923	24,931	24,939	24,947	24,956	24,964
Lauderdale	12,305	12,311	12,311	12,311	12,318	12,325	12,331	12,338	12,345	12,352	12,358
Madison	14,949	14,954	14,954	14,954	14,963	14,972	14,982	14,992	15,001	15,011	15,021
Rankin	22,553	22,565	22,565	22,565	22,581	22,596	22,613	22,630	22,647	22,665	22,683

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:		
	12/2	12/3	12/4	12/5	12/7	12/9	12/11
DeSoto	33,342	33,360	33,360	33,360	33,396 (6,679) [1,603] {802}	33,430 (6,686) [1,605] {802}	33,465 (6,693) [1,606] {803}
Harrison	34,981	34,999	34,999	34,999	35,035 (7,007) [1,682] {841}	35,070 (7,014) [1,683] {842}	35,107 (7,021) [1,685] {843}
Hinds	32,718	32,743	32,743	32,743	32,785 (6,557) [1,574] {787}	32,829 (6,566) [1,576] {788}	32,875 (6,575) [1,578] {789}
Jackson	24,896	24,906	24,906	24,906	24,923 (4,985) [1,196] {598}	24,939 (4,988) [1,197] {599}	24,956 (4,991) [1,198] {599}
Lauderdale	12,305	12,311	12,311	12,311	12,325 (2,465) [592] {296}	12,338 (2,468) [592] {296}	12,352 (2,470) [593] {296}
Madison	14,949	14,954	14,954	14,954	14,972 (2,994) [719] {359}	14,992 (2,998) [720] {360}	15,011 (3,002) [721] {360}
Rankin	22,553	22,565	22,565	22,565	22,596 (4,519) [1,085] {542}	22,630 (4,526) [1,086] {543}	22,665 (4,533) [1,088] {544}

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.