IEM's AI Modeling: Short-term COVID-19 Projections
Date: 12/29/21

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 12/29/21 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
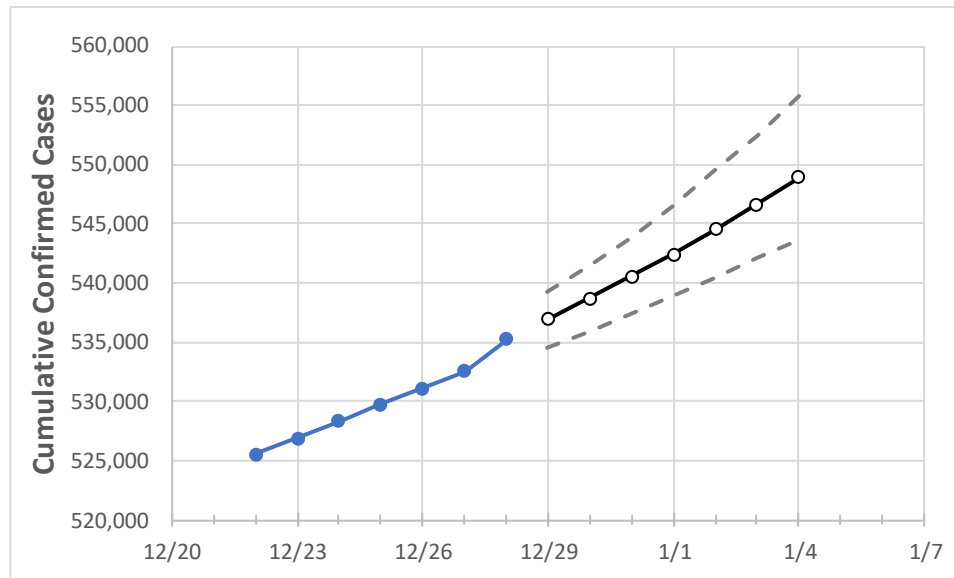
	Actual Confirmed Cases On:				Projected Cases For:						
	12/25	12/26	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3	1/4
Mississippi	529,737	531,148	532,560	535,258	536,910	538,673	540,524	542,457	544,497	546,622	548,924

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:						
	12/25	12/26	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3	1/4
DeSoto	34,588	34,726	34,864	35,201	35,369	35,547	35,731	35,929	36,139	36,369	36,598
Harrison	35,479	35,522	35,565	35,682	35,729	35,779	35,828	35,882	35,937	35,995	36,056
Hinds	34,374	34,603	34,832	35,081	35,368	35,683	36,023	36,398	36,802	37,240	37,725
Jackson	25,198	25,228	25,257	25,336	25,371	25,406	25,443	25,481	25,523	25,566	25,611
Lauderdale	12,546	12,570	12,594	12,642	12,669	12,698	12,728	12,761	12,794	12,830	12,866
Madison	15,605	15,687	15,769	15,872	15,975	16,086	16,207	16,336	16,479	16,631	16,798
Rankin	23,412	23,515	23,618	23,735	23,857	23,988	24,129	24,279	24,441	24,616	24,805

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:		
	12/25	12/26	12/27	12/28	12/30	1/1	1/3
DeSoto	34,588	34,726	34,864	35,201	35,547 (7,109) [1,706] {853}	35,929 (7,186) [1,725] {862}	36,369 (7,274) [1,746] {873}
Harrison	35,479	35,522	35,565	35,682	35,779 (7,156) [1,717] {859}	35,882 (7,176) [1,722] {861}	35,995 (7,199) [1,728] {864}
Hinds	34,374	34,603	34,832	35,081	35,683 (7,137) [1,713] {856}	36,398 (7,280) [1,747] {874}	37,240 (7,448) [1,788] {894}
Jackson	25,198	25,228	25,257	25,336	25,406 (5,081) [1,219] {610}	25,481 (5,096) [1,223] {612}	25,566 (5,113) [1,227] {614}
Lauderdale	12,546	12,570	12,594	12,642	12,698 (2,540) [610] {305}	12,761 (2,552) [613] {306}	12,830 (2,566) [616] {308}
Madison	15,605	15,687	15,769	15,872	16,086 (3,217) [772] {386}	16,336 (3,267) [784] {392}	16,631 (3,326) [798] {399}
Rankin	23,412	23,515	23,618	23,735	23,988 (4,798) [1,151] {576}	24,279 (4,856) [1,165] {583}	24,616 (4,923) [1,182] {591}

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.