IEM's AI Modeling: Short-term COVID-19 Projections
Date: 9/15/21

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 9/15/21 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
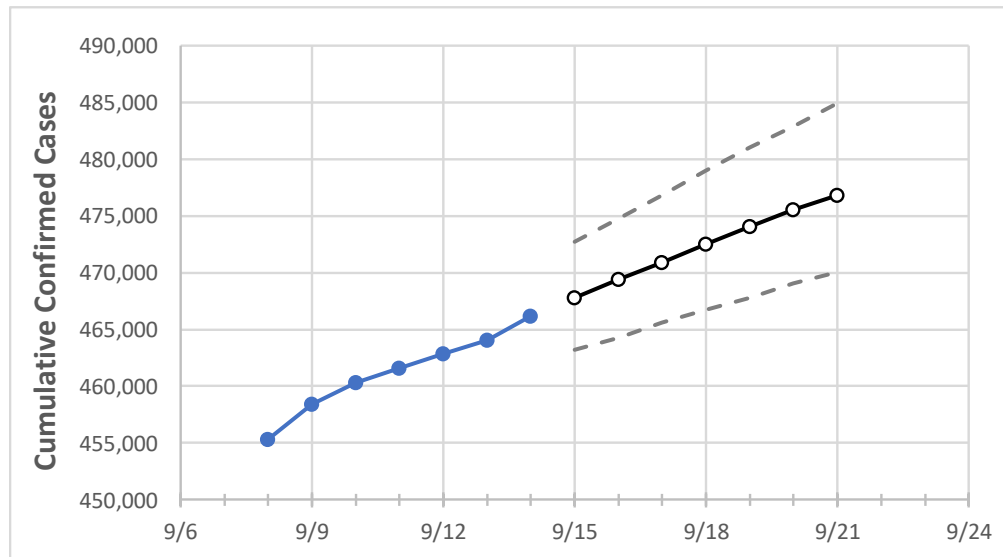
	Actual Confirmed Cases On:				Projected Cases For:						
	9/11	9/12	9/13	9/14	9/15	9/16	9/17	9/18	9/19	9/20	9/21
Mississippi	461,566	462,821	464,075	466,145	467,763	469,378	470,913	472,537	474,041	475,516	476,838

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:						
	9/11	9/12	9/13	9/14	9/15	9/16	9/17	9/18	9/19	9/20	9/21
DeSoto	28,999	29,108	29,217	29,346	29,469	29,589	29,706	29,822	29,940	30,057	30,170
Harrison	31,377	31,490	31,603	31,767	31,897	32,021	32,141	32,265	32,383	32,501	32,604
Hinds	30,242	30,289	30,337	30,454	30,525	30,595	30,661	30,725	30,793	30,855	30,918
Jackson	22,516	22,592	22,669	22,754	22,845	22,933	23,014	23,099	23,181	23,262	23,341
Lauderdale	11,100	11,109	11,119	11,187	11,216	11,246	11,269	11,299	11,328	11,354	11,376
Madison	13,831	13,856	13,880	13,914	13,955	13,997	14,034	14,072	14,110	14,148	14,185
Rankin	20,818	20,843	20,867	20,946	21,006	21,060	21,109	21,163	21,213	21,265	21,312

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:		
	9/11	9/12	9/13	9/14	9/16	9/18	9/20
DeSoto	28,999	29,108	29,217	29,346	29,589 (5,918) [1,420] {710}	29,822 (5,964) [1,431] {716}	30,057 (6,011) [1,443] {721}
Harrison	31,377	31,490	31,603	31,767	32,021 (6,404) [1,537] {769}	32,265 (6,453) [1,549] {774}	32,501 (6,500) [1,560] {780}
Hinds	30,242	30,289	30,337	30,454	30,595 (6,119) [1,469] {734}	30,725 (6,145) [1,475] {737}	30,855 (6,171) [1,481] {741}
Jackson	22,516	22,592	22,669	22,754	22,933 (4,587) [1,101] {550}	23,099 (4,620) [1,109] {554}	23,262 (4,652) [1,117] {558}
Lauderdale	11,100	11,109	11,119	11,187	11,246 (2,249) [540] {270}	11,299 (2,260) [542] {271}	11,354 (2,271) [545] {272}
Madison	13,831	13,856	13,880	13,914	13,997 (2,799) [672] {336}	14,072 (2,814) [675] {338}	14,148 (2,830) [679] {340}
Rankin	20,818	20,843	20,867	20,946	21,060 (4,212) [1,011] {505}	21,163 (4,233) [1,016] {508}	21,265 (4,253) [1,021] {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.