IEM's AI Modeling: Short-term COVID-19 Projections
Date: 7/14/21

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 7/14/21 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.

Michigan State Projections
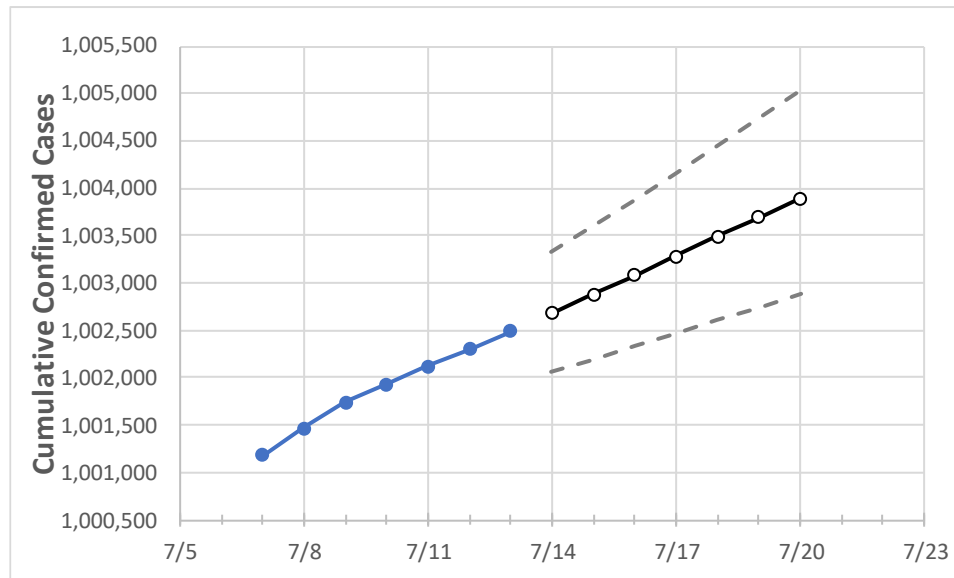
	Actual Confirmed Cases On:				Projected Cases For:						
	7/10	7/11	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20
Michigan	1,001,931	1,002,117	1,002,302	1,002,488	1,002,684	1,002,880	1,003,082	1,003,283	1,003,488	1,003,694	1,003,896

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.

Michigan Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	7/10	7/11	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20
Genesee	41,798	41,802	41,805	41,808	41,812	41,816	41,819	41,823	41,827	41,831	41,835
Ingham	24,947	24,951	24,954	24,958	24,962	24,965	24,969	24,973	24,977	24,981	24,985
Kent	73,922	73,936	73,951	73,965	73,992	74,019	74,046	74,072	74,097	74,124	74,151
Livingston	16,788	16,793	16,798	16,803	16,807	16,811	16,815	16,819	16,824	16,828	16,833
Macomb	100,355	100,371	100,386	100,401	100,415	100,429	100,443	100,458	100,473	100,487	100,503
Monroe	15,452	15,455	15,457	15,460	15,462	15,465	15,467	15,469	15,472	15,474	15,477
Oakland	119,000	119,031	119,063	119,094	119,127	119,160	119,196	119,232	119,269	119,307	119,346
Washtenaw	26,552	26,557	26,562	26,567	26,571	26,576	26,581	26,586	26,590	26,595	26,600
Wayne	166,383	166,422	166,462	166,501	166,547	166,592	166,637	166,682	166,728	166,772	166,817

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.*

Michigan Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	7/10	7/11	7/12	7/13	7/15	7/17	7/19
Genesee	41,798	41,802	41,805	41,808	41,816 (8,363) [2,007] {1,004}	41,823 (8,365) [2,008] {1,004}	41,831 (8,366) [2,008] {1,004}
Ingham	24,947	24,951	24,954	24,958	24,965 (4,993) [1,198] {599}	24,973 (4,995) [1,199] {599}	24,981 (4,996) [1,199] {600}
Kent	73,922	73,936	73,951	73,965	74,019 (14,804) [3,553] {1,776}	74,072 (14,814) [3,555] {1,778}	74,124 (14,825) [3,558] {1,779}
Livingston	16,788	16,793	16,798	16,803	16,811 (3,362) [807] {403}	16,819 (3,364) [807] {404}	16,828 (3,366) [808] {404}
Macomb	100,355	100,371	100,386	100,401	100,429 (20,086) [4,821] {2,410}	100,458 (20,092) [4,822] {2,411}	100,487 (20,097) [4,823] {2,412}
Monroe	15,452	15,455	15,457	15,460	15,465 (3,093) [742] {371}	15,469 (3,094) [743] {371}	15,474 (3,095) [743] {371}
Oakland	119,000	119,031	119,063	119,094	119,160 (23,832) [5,720] {2,860}	119,232 (23,846) [5,723] {2,862}	119,307 (23,861) [5,727] {2,863}
Washtenaw	26,552	26,557	26,562	26,567	26,576 (5,315) [1,276] {638}	26,586 (5,317) [1,276] {638}	26,595 (5,319) [1,277] {638}
Wayne	166,383	166,422	166,462	166,501	166,592 (33,318) [7,996] {3,998}	166,682 (33,336) [8,001] {4,000}	166,772 (33,354) [8,005] {4,003}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.