IEM's AI Modeling: Short-term COVID-19 Projections
Date: 8/25/21

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 not 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 8/25/21 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
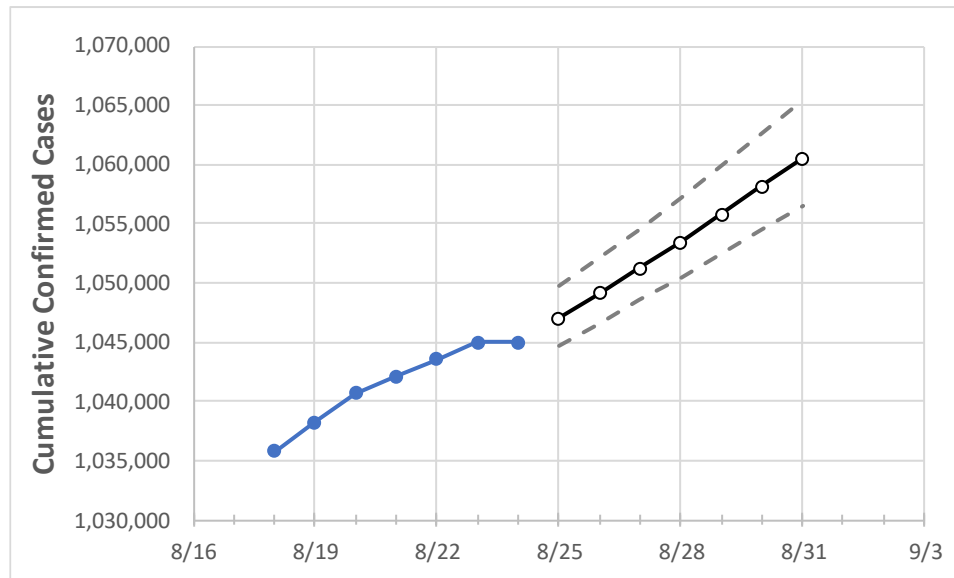
	Actual Confirmed Cases On:				Projected Cases For:						
	8/21	8/22	8/23	8/24	8/25	8/26	8/27	8/28	8/29	8/30	8/31
Michigan	1,042,101	1,043,530	1,044,958	1,044,958	1,047,006	1,049,109	1,051,282	1,053,470	1,055,775	1,058,125	1,060,487

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:						
	8/21	8/22	8/23	8/24	8/25	8/26	8/27	8/28	8/29	8/30	8/31
Genesee	43,289	43,345	43,400	43,400	43,491	43,581	43,676	43,776	43,876	43,982	44,091
Ingham	26,013	26,042	26,070	26,070	26,112	26,154	26,197	26,239	26,283	26,327	26,372
Kent	76,435	76,529	76,624	76,624	76,785	76,950	77,122	77,298	77,485	77,678	77,874
Livingston	17,737	17,790	17,842	17,842	17,904	17,970	18,037	18,107	18,180	18,256	18,335
Macomb	103,810	103,915	104,021	104,021	104,174	104,330	104,487	104,650	104,813	104,978	105,148
Monroe	16,075	16,099	16,122	16,122	16,153	16,185	16,217	16,251	16,285	16,320	16,357
Oakland	124,433	124,586	124,739	124,739	124,980	125,226	125,473	125,726	125,989	126,256	126,529
Washtenaw	27,812	27,862	27,911	27,911	27,979	28,049	28,122	28,196	28,272	28,352	28,433
Wayne	173,139	173,358	173,578	173,578	173,877	174,169	174,474	174,780	175,096	175,408	175,738

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:		
	8/21	8/22	8/23	8/24	8/26	8/28	8/30
Genesee	43,289	43,345	43,400	43,400	43,581 (8,716) [2,092] {1,046}	43,776 (8,755) [2,101] {1,051}	43,982 (8,796) [2,111] {1,056}
Ingham	26,013	26,042	26,070	26,070	26,154 (5,231) [1,255] {628}	26,239 (5,248) [1,259] {630}	26,327 (5,265) [1,264] {632}
Kent	76,435	76,529	76,624	76,624	76,950 (15,390) [3,694] {1,847}	77,298 (15,460) [3,710] {1,855}	77,678 (15,536) [3,729] {1,864}
Livingston	17,737	17,790	17,842	17,842	17,970 (3,594) [863] {431}	18,107 (3,621) [869] {435}	18,256 (3,651) [876] {438}
Macomb	103,810	103,915	104,021	104,021	104,330 (20,866) [5,008] {2,504}	104,650 (20,930) [5,023] {2,512}	104,978 (20,996) [5,039] {2,519}
Monroe	16,075	16,099	16,122	16,122	16,185 (3,237) [777] {388}	16,251 (3,250) [780] {390}	16,320 (3,264) [783] {392}
Oakland	124,433	124,586	124,739	124,739	125,226 (25,045) [6,011] {3,005}	125,726 (25,145) [6,035] {3,017}	126,256 (25,251) [6,060] {3,030}
Washtenaw	27,812	27,862	27,911	27,911	28,049 (5,610) [1,346] {673}	28,196 (5,639) [1,353] {677}	28,352 (5,670) [1,361] {680}
Wayne	173,139	173,358	173,578	173,578	174,169 (34,834) [8,360] {4,180}	174,780 (34,956) [8,389] {4,195}	175,408 (35,082) [8,420] {4,210}

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.