IEM's AI Modeling: Short-term COVID-19 Projections
Date: 10/27/21

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 10/27/21 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
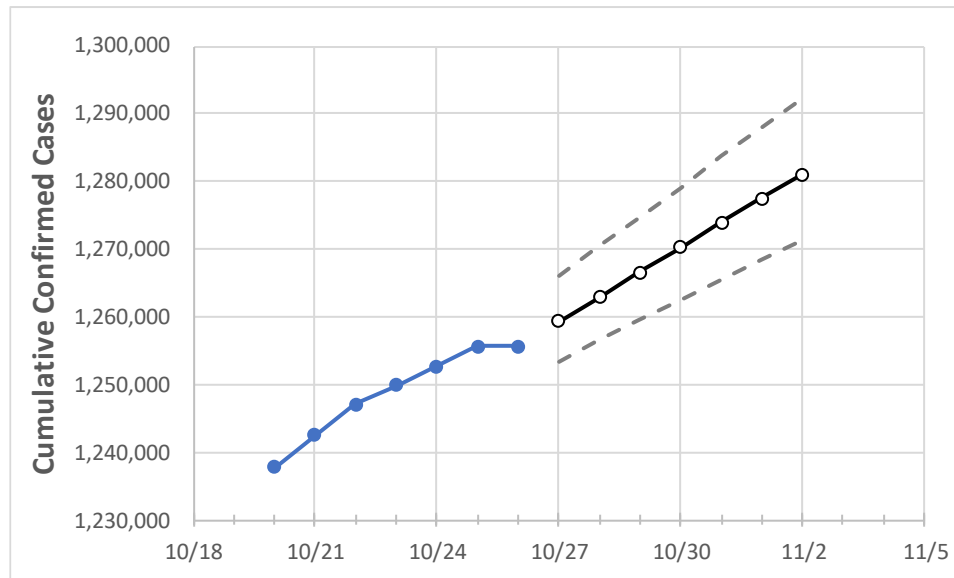
Actual Confirmed Cases On:				Projected Cases For:						
10/23	10/24	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1	11/2
Michigan	1,249,880	1,252,738	1,255,595	1,255,595	1,259,311	1,262,923	1,266,559	1,270,247	1,273,919	1,277,466	1,281,068

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:						
	10/23	10/24	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1	11/2
Genesee	51,576	51,709	51,842	51,842	52,029	52,224	52,410	52,605	52,795	52,990	53,187
Ingham	30,684	30,740	30,797	30,797	30,870	30,942	31,013	31,082	31,154	31,222	31,291
Kent	92,456	92,684	92,913	92,913	93,219	93,519	93,822	94,122	94,425	94,730	95,043
Livingston	22,814	22,880	22,946	22,946	23,031	23,120	23,202	23,284	23,364	23,450	23,530
Macomb	120,214	120,493	120,771	120,771	121,064	121,360	121,647	121,942	122,229	122,520	122,805
Monroe	20,209	20,260	20,312	20,312	20,384	20,454	20,523	20,593	20,661	20,729	20,794
Oakland	144,554	144,837	145,119	145,119	145,455	145,782	146,113	146,440	146,772	147,095	147,417
Washtenaw	33,005	33,068	33,130	33,130	33,207	33,285	33,360	33,436	33,509	33,586	33,657
Wayne	197,451	197,825	198,198	198,198	198,635	199,074	199,504	199,936	200,366	200,806	201,242

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:		
	10/23	10/24	10/25	10/26	10/28	10/30	11/1
Genesee	51,576	51,709	51,842	51,842	52,224 (10,445) [2,507] {1,253}	52,605 (10,521) [2,525] {1,263}	52,990 (10,598) [2,544] {1,272}
Ingham	30,684	30,740	30,797	30,797	30,942 (6,188) [1,485] {743}	31,082 (6,216) [1,492] {746}	31,222 (6,244) [1,499] {749}
Kent	92,456	92,684	92,913	92,913	93,519 (18,704) [4,489] {2,244}	94,122 (18,824) [4,518] {2,259}	94,730 (18,946) [4,547] {2,274}
Livingston	22,814	22,880	22,946	22,946	23,120 (4,624) [1,110] {555}	23,284 (4,657) [1,118] {559}	23,450 (4,690) [1,126] {563}
Macomb	120,214	120,493	120,771	120,771	121,360 (24,272) [5,825] {2,913}	121,942 (24,388) [5,853] {2,927}	122,520 (24,504) [5,881] {2,940}
Monroe	20,209	20,260	20,312	20,312	20,454 (4,091) [982] {491}	20,593 (4,119) [988] {494}	20,729 (4,146) [995] {497}
Oakland	144,554	144,837	145,119	145,119	145,782 (29,156) [6,998] {3,499}	146,440 (29,288) [7,029] {3,515}	147,095 (29,419) [7,061] {3,530}
Washtenaw	33,005	33,068	33,130	33,130	33,285 (6,657) [1,598] {799}	33,436 (6,687) [1,605] {802}	33,586 (6,717) [1,612] {806}
Wayne	197,451	197,825	198,198	198,198	199,074 (39,815) [9,556] {4,778}	199,936 (39,987) [9,597] {4,798}	200,806 (40,161) [9,639] {4,819}

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.