

IEM's AI Modeling: Short-term COVID-19 Projections

Date: 12/28/20

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 12/28/20 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.

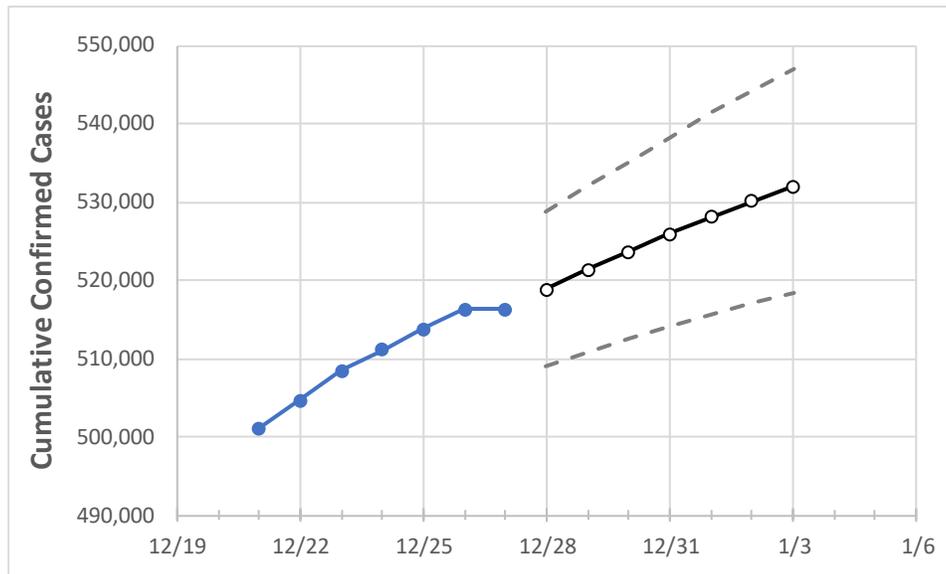
IEM's Modeling Lead

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:						
	12/24	12/25	12/26	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3
Michigan	511,075	513,700	516,326	516,326	518,843	521,293	523,674	525,919	528,017	530,072	532,040

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 20%, and are often within 10%, of actual confirmed cases.

Michigan Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	12/24	12/25	12/26	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3
Genesee	20,917	21,035	21,154	21,154	21,294	21,424	21,552	21,680	21,798	21,910	22,016
Ingham	12,163	12,231	12,299	12,299	12,371	12,441	12,510	12,575	12,638	12,699	12,756
Kent	42,014	42,193	42,373	42,373	42,520	42,665	42,800	42,928	43,049	43,160	43,264
Livingston	7,558	7,593	7,628	7,628	7,657	7,686	7,713	7,739	7,762	7,786	7,808
Macomb	48,265	48,471	48,676	48,676	48,853	49,021	49,178	49,324	49,465	49,598	49,721
Monroe	7,353	7,383	7,412	7,412	7,446	7,479	7,510	7,541	7,569	7,597	7,623
Oakland	59,207	59,466	59,724	59,724	59,994	60,246	60,492	60,731	60,968	61,188	61,396
Washtenaw	13,210	13,269	13,329	13,329	13,409	13,484	13,561	13,635	13,705	13,773	13,843
Wayne	82,605	82,994	83,383	83,383	83,788	84,187	84,566	84,938	85,290	85,627	85,956

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:											
	12/24	12/25	12/26	12/27	12/29				12/31				1/2			
Genesee	20,917	21,035	21,154	21,154	21,424	(4,285)	[1,028]	{514}	21,680	(4,336)	[1,041]	{520}	21,910	(4,382)	[1,052]	{526}
Ingham	12,163	12,231	12,299	12,299	12,441	(2,488)	[597]	{299}	12,575	(2,515)	[604]	{302}	12,699	(2,540)	[610]	{305}
Kent	42,014	42,193	42,373	42,373	42,665	(8,533)	[2,048]	{1,024}	42,928	(8,586)	[2,061]	{1,030}	43,160	(8,632)	[2,072]	{1,036}
Livingston	7,558	7,593	7,628	7,628	7,686	(1,537)	[369]	{184}	7,739	(1,548)	[371]	{186}	7,786	(1,557)	[374]	{187}
Macomb	48,265	48,471	48,676	48,676	49,021	(9,804)	[2,353]	{1,177}	49,324	(9,865)	[2,368]	{1,184}	49,598	(9,920)	[2,381]	{1,190}
Monroe	7,353	7,383	7,412	7,412	7,479	(1,496)	[359]	{179}	7,541	(1,508)	[362]	{181}	7,597	(1,519)	[365]	{182}
Oakland	59,207	59,466	59,724	59,724	60,246	(12,049)	[2,892]	{1,446}	60,731	(12,146)	[2,915]	{1,458}	61,188	(12,238)	[2,937]	{1,469}
Washtenaw	13,210	13,269	13,329	13,329	13,484	(2,697)	[647]	{324}	13,635	(2,727)	[654]	{327}	13,773	(2,755)	[661]	{331}
Wayne	82,605	82,994	83,383	83,383	84,187	(16,837)	[4,041]	{2,020}	84,938	(16,988)	[4,077]	{2,039}	85,627	(17,125)	[4,110]	{2,055}

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.