

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

Date: 12/31/20

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 12/31/20 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.

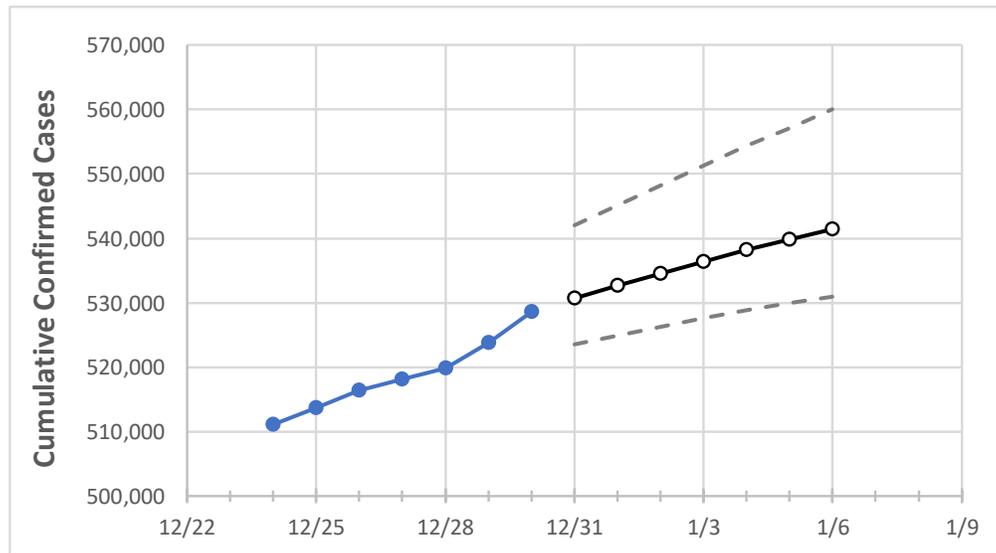
IEM's Modeling Lead

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:					
	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3	1/4	1/5	1/6
Michigan	518,101	519,876	523,839	528,621	530,655	532,681	534,529	536,401	538,172	539,816	541,375

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:						
	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3	1/4	1/5	1/6
Genesee	21,230	21,306	21,479	21,619	21,709	21,795	21,876	21,953	22,024	22,091	22,155
Ingham	12,358	12,417	12,510	12,635	12,700	12,760	12,821	12,879	12,937	12,990	13,042
Kent	42,539	42,704	42,936	43,274	43,438	43,598	43,755	43,906	44,058	44,203	44,346
Livingston	7,650	7,671	7,748	7,825	7,853	7,879	7,904	7,928	7,952	7,975	7,996
Macomb	48,781	48,885	49,189	49,473	49,615	49,748	49,870	49,988	50,098	50,201	50,299
Monroe	7,442	7,471	7,535	7,595	7,625	7,653	7,681	7,707	7,731	7,755	7,775
Oakland	59,936	60,147	60,724	61,195	61,455	61,703	61,936	62,157	62,387	62,600	62,812
Washtenaw	13,389	13,448	13,595	13,702	13,761	13,814	13,867	13,918	13,967	14,013	14,059
Wayne	83,642	83,901	84,452	84,941	85,262	85,559	85,840	86,118	86,380	86,623	86,873

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:											
	12/27	12/28	12/29	12/30	1/1			1/3			1/5					
Genesee	21,230	21,306	21,479	21,619	21,795	(4,359)	[1,046]	{523}	21,953	(4,391)	[1,054]	{527}	22,091	(4,418)	[1,060]	{530}
Ingham	12,358	12,417	12,510	12,635	12,760	(2,552)	[613]	{306}	12,879	(2,576)	[618]	{309}	12,990	(2,598)	[624]	{312}
Kent	42,539	42,704	42,936	43,274	43,598	(8,720)	[2,093]	{1,046}	43,906	(8,781)	[2,107]	{1,054}	44,203	(8,841)	[2,122]	{1,061}
Livingston	7,650	7,671	7,748	7,825	7,879	(1,576)	[378]	{189}	7,928	(1,586)	[381]	{190}	7,975	(1,595)	[383]	{191}
Macomb	48,781	48,885	49,189	49,473	49,748	(9,950)	[2,388]	{1,194}	49,988	(9,998)	[2,399]	{1,200}	50,201	(10,040)	[2,410]	{1,205}
Monroe	7,442	7,471	7,535	7,595	7,653	(1,531)	[367]	{184}	7,707	(1,541)	[370]	{185}	7,755	(1,551)	[372]	{186}
Oakland	59,936	60,147	60,724	61,195	61,703	(12,341)	[2,962]	{1,481}	62,157	(12,431)	[2,984]	{1,492}	62,600	(12,520)	[3,005]	{1,502}
Washtenaw	13,389	13,448	13,595	13,702	13,814	(2,763)	[663]	{332}	13,918	(2,784)	[668]	{334}	14,013	(2,803)	[673]	{336}
Wayne	83,642	83,901	84,452	84,941	85,559	(17,112)	[4,107]	{2,053}	86,118	(17,224)	[4,134]	{2,067}	86,623	(17,325)	[4,158]	{2,079}

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.