

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

Date: 3/29/22

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 3/29/22 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.

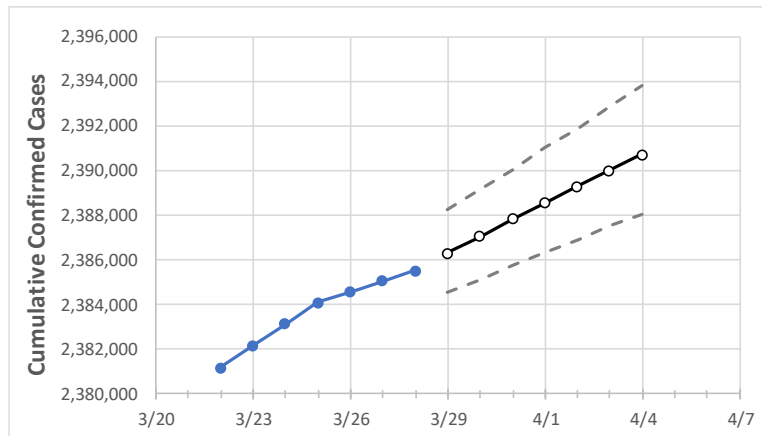
IEM's Modeling Lead

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:						
	3/25	3/26	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4
Michigan	2,384,088	2,384,571	2,385,053	2,385,536	2,386,306	2,387,068	2,387,842	2,388,555	2,389,306	2,390,035	2,390,738

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:							
	3/25	3/26	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4	
Genesee	100,916	100,925	100,935	100,944	100,969	100,999	101,023	101,049	101,076	101,100	101,126	
Ingham	63,718	63,734	63,750	63,766	63,787	63,809	63,829	63,850	63,870	63,890	63,910	
Kent	166,027	166,052	166,077	166,102	166,134	166,165	166,195	166,226	166,257	166,286	166,315	
Livingston	45,867	45,876	45,885	45,894	45,920	45,944	45,968	45,994	46,018	46,044	46,068	
Macomb	228,102	228,186	228,270	228,354	228,476	228,597	228,713	228,839	228,950	229,069	229,183	
Monroe	37,850	37,857	37,863	37,870	37,881	37,893	37,903	37,915	37,926	37,937	37,948	
Oakland	285,014	285,077	285,141	285,204	285,307	285,408	285,508	285,611	285,706	285,805	285,905	
Washtenaw	74,218	74,260	74,301	74,343	74,397	74,451	74,504	74,558	74,613	74,668	74,724	
Wayne	397,621	397,724	397,826	397,929	398,145	398,348	398,562	398,787	398,992	399,227	399,436	

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:											
	3/25	3/26	3/27	3/28	3/30				4/1				4/3			
Genesee	100,916	100,925	100,935	100,944	100,999	(20,200)	[4,848]	{2,424}	101,049	(20,210)	[4,850]	{2,425}	101,100	(20,220)	[4,853]	{2,426}
Ingham	63,718	63,734	63,750	63,766	63,809	(12,762)	[3,063]	{1,531}	63,850	(12,770)	[3,065]	{1,532}	63,890	(12,778)	[3,067]	{1,533}
Kent	166,027	166,052	166,077	166,102	166,165	(33,233)	[7,976]	{3,988}	166,226	(33,245)	[7,979]	{3,989}	166,286	(33,257)	[7,982]	{3,991}
Livingston	45,867	45,876	45,885	45,894	45,944	(9,189)	[2,205]	{1,103}	45,994	(9,199)	[2,208]	{1,104}	46,044	(9,209)	[2,210]	{1,105}
Macomb	228,102	228,186	228,270	228,354	228,597	(45,719)	[10,973]	{5,486}	228,839	(45,768)	[10,984]	{5,492}	229,069	(45,814)	[10,995]	{5,498}
Monroe	37,850	37,857	37,863	37,870	37,893	(7,579)	[1,819]	{909}	37,915	(7,583)	[1,820]	{910}	37,937	(7,587)	[1,821]	{910}
Oakland	285,014	285,077	285,141	285,204	285,408	(57,082)	[13,700]	{6,850}	285,611	(57,122)	[13,709]	{6,855}	285,805	(57,161)	[13,719]	{6,859}
Washtenaw	74,218	74,260	74,301	74,343	74,451	(14,890)	[3,574]	{1,787}	74,558	(14,912)	[3,579]	{1,789}	74,668	(14,934)	[3,584]	{1,792}
Wayne	397,621	397,724	397,826	397,929	398,348	(79,670)	[19,121]	{9,560}	398,787	(79,757)	[19,142]	{9,571}	399,227	(79,845)	[19,163]	{9,581}

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.