

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

Date: 6/25/21

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 6/25/21 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.

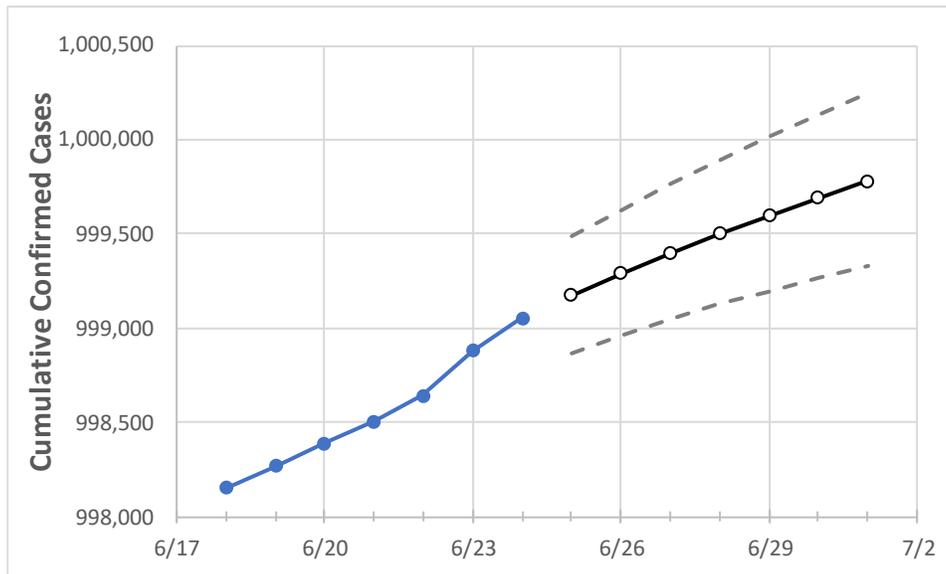
IEM's Modeling Lead

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:					
	6/21	6/22	6/23	6/24	6/25	6/26	6/27	6/28	6/29	6/30	7/1	
Michigan	998,507	998,641	998,877	999,052	999,172	999,290	999,397	999,501	999,599	999,691	999,783	

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:					
	6/21	6/22	6/23	6/24	6/25	6/26	6/27	6/28	6/29	6/30	7/1
Genesee	41,725	41,731	41,736	41,738	41,741	41,744	41,746	41,749	41,751	41,753	41,755
Ingham	24,872	24,883	24,886	24,888	24,890	24,892	24,894	24,896	24,898	24,899	24,901
Kent	73,285	73,316	73,386	73,443	73,462	73,481	73,500	73,518	73,536	73,553	73,570
Livingston	16,730	16,732	16,733	16,735	16,737	16,739	16,740	16,742	16,743	16,745	16,746
Macomb	100,122	100,130	100,145	100,155	100,164	100,171	100,179	100,186	100,192	100,198	100,204
Monroe	15,411	15,405	15,407	15,408	15,410	15,411	15,413	15,415	15,416	15,417	15,419
Oakland	118,585	118,600	118,638	118,652	118,667	118,682	118,695	118,708	118,720	118,731	118,742
Washtenaw	26,481	26,480	26,490	26,491	26,495	26,498	26,502	26,506	26,509	26,512	26,516
Wayne	165,554	165,591	165,633	165,675	165,704	165,730	165,756	165,781	165,805	165,827	165,847

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:											
	6/21	6/22	6/23	6/24	6/26			6/28			6/30					
Genesee	41,725	41,731	41,736	41,738	41,744	(8,349)	[2,004]	{1,002}	41,749	(8,350)	[2,004]	{1,002}	41,753	(8,351)	[2,004]	{1,002}
Ingham	24,872	24,883	24,886	24,888	24,892	(4,978)	[1,195]	{597}	24,896	(4,979)	[1,195]	{598}	24,899	(4,980)	[1,195]	{598}
Kent	73,285	73,316	73,386	73,443	73,481	(14,696)	[3,527]	{1,764}	73,518	(14,704)	[3,529]	{1,764}	73,553	(14,711)	[3,531]	{1,765}
Livingston	16,730	16,732	16,733	16,735	16,739	(3,348)	[803]	{402}	16,742	(3,348)	[804]	{402}	16,745	(3,349)	[804]	{402}
Macomb	100,122	100,130	100,145	100,155	100,171	(20,034)	[4,808]	{2,404}	100,186	(20,037)	[4,809]	{2,404}	100,198	(20,040)	[4,810]	{2,405}
Monroe	15,411	15,405	15,407	15,408	15,411	(3,082)	[740]	{370}	15,415	(3,083)	[740]	{370}	15,417	(3,083)	[740]	{370}
Oakland	118,585	118,600	118,638	118,652	118,682	(23,736)	[5,697]	{2,848}	118,708	(23,742)	[5,698]	{2,849}	118,731	(23,746)	[5,699]	{2,850}
Washtenaw	26,481	26,480	26,490	26,491	26,498	(5,300)	[1,272]	{636}	26,506	(5,301)	[1,272]	{636}	26,512	(5,302)	[1,273]	{636}
Wayne	165,554	165,591	165,633	165,675	165,730	(33,146)	[7,955]	{3,978}	165,781	(33,156)	[7,957]	{3,979}	165,827	(33,165)	[7,960]	{3,980}

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.