

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

Date: 6/4/21

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 6/4/21 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.

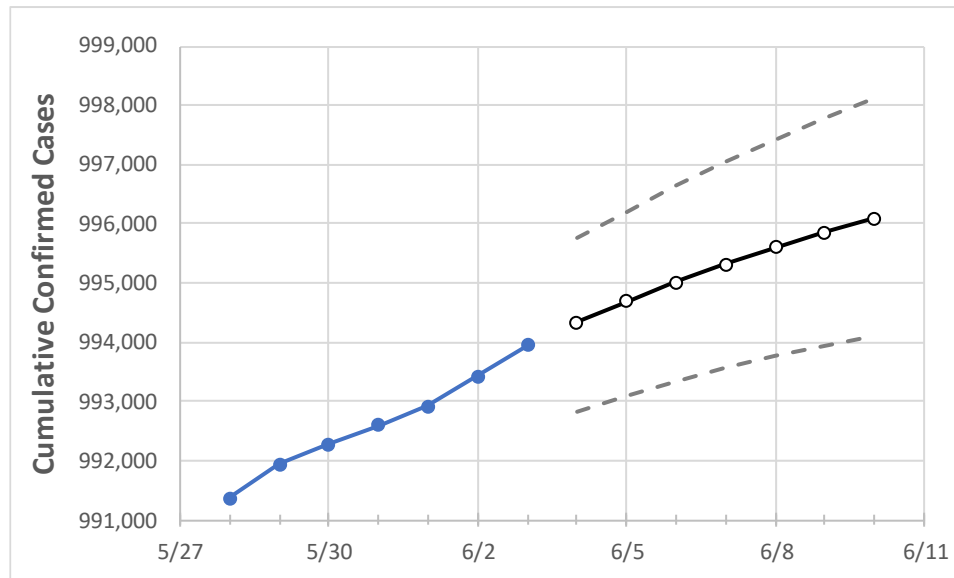
IEM's Modeling Lead

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:						
	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7	6/8	6/9	6/10	
Michigan	992,597	992,925	993,422	993,952	994,340	994,695	995,019	995,320	995,603	995,852	996,096	

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:							
	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7	6/8	6/9	6/10	
Genesee	41,586	41,593	41,607	41,619	41,629	41,638	41,647	41,654	41,661	41,668	41,674	
Ingham	24,751	24,761	24,770	24,780	24,789	24,798	24,806	24,813	24,820	24,827	24,833	
Kent	72,777	72,807	72,850	72,887	72,930	72,970	73,006	73,039	73,071	73,102	73,130	
Livingston	16,624	16,628	16,634	16,653	16,659	16,664	16,669	16,673	16,678	16,681	16,685	
Macomb	99,651	99,677	99,717	99,751	99,787	99,818	99,850	99,878	99,903	99,928	99,950	
Monroe	15,333	15,336	15,339	15,345	15,351	15,357	15,362	15,367	15,372	15,377	15,381	
Oakland	117,875	117,919	117,976	118,035	118,079	118,123	118,159	118,197	118,232	118,261	118,291	
Washtenaw	26,382	26,386	26,393	26,400	26,406	26,412	26,418	26,423	26,428	26,432	26,436	
Wayne	164,302	164,360	164,451	164,555	164,627	164,689	164,750	164,808	164,862	164,910	164,955	

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:											
	5/31	6/1	6/2	6/3	6/5				6/7				6/9			
Genesee	41,586	41,593	41,607	41,619	41,638	(8,328)	[1,999]	{999}	41,654	(8,331)	[1,999]	{1,000}	41,668	(8,334)	[2,000]	{1,000}
Ingham	24,751	24,761	24,770	24,780	24,798	(4,960)	[1,190]	{595}	24,813	(4,963)	[1,191]	{596}	24,827	(4,965)	[1,192]	{596}
Kent	72,777	72,807	72,850	72,887	72,970	(14,594)	[3,503]	{1,751}	73,039	(14,608)	[3,506]	{1,753}	73,102	(14,620)	[3,509]	{1,754}
Livingston	16,624	16,628	16,634	16,653	16,664	(3,333)	[800]	{400}	16,673	(3,335)	[800]	{400}	16,681	(3,336)	[801]	{400}
Macomb	99,651	99,677	99,717	99,751	99,818	(19,964)	[4,791]	{2,396}	99,878	(19,976)	[4,794]	{2,397}	99,928	(19,986)	[4,797]	{2,398}
Monroe	15,333	15,336	15,339	15,345	15,357	(3,071)	[737]	{369}	15,367	(3,073)	[738]	{369}	15,377	(3,075)	[738]	{369}
Oakland	117,875	117,919	117,976	118,035	118,123	(23,625)	[5,670]	{2,835}	118,197	(23,639)	[5,673]	{2,837}	118,261	(23,652)	[5,677]	{2,838}
Washtenaw	26,382	26,386	26,393	26,400	26,412	(5,282)	[1,268]	{634}	26,423	(5,285)	[1,268]	{634}	26,432	(5,286)	[1,269]	{634}
Wayne	164,302	164,360	164,451	164,555	164,689	(32,938)	[7,905]	{3,953}	164,808	(32,962)	[7,911]	{3,955}	164,910	(32,982)	[7,916]	{3,958}

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.