

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

Date: 5/28/21

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 5/28/21 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.

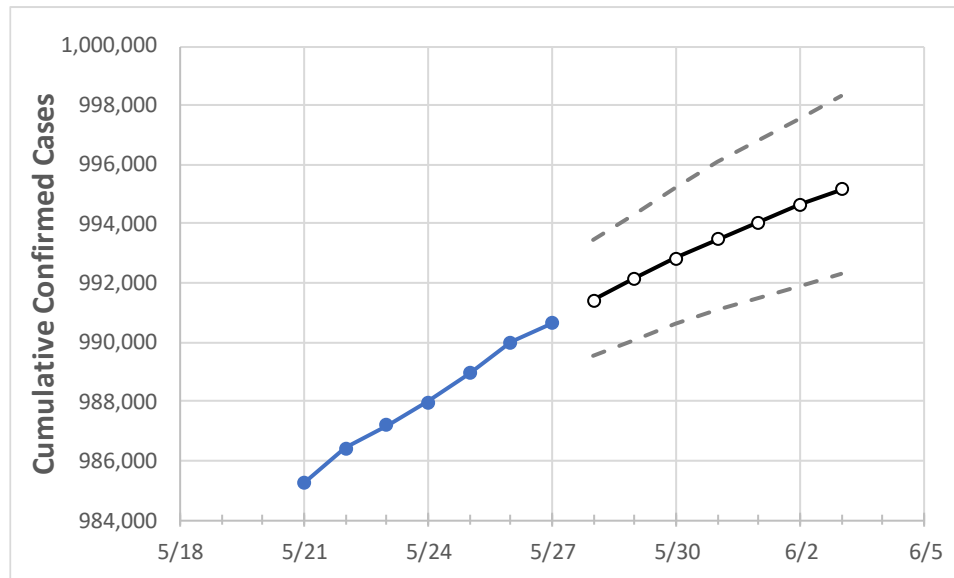
IEM's Modeling Lead

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:					
	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31	6/1	6/2	6/3
Michigan	987,974	988,947	990,002	990,638	991,414	992,145	992,822	993,463	994,059	994,643	995,176

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:					
	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31	6/1	6/2	6/3
Genesee	41,459	41,484	41,508	41,539	41,561	41,581	41,599	41,615	41,631	41,647	41,661
Ingham	24,649	24,668	24,687	24,697	24,714	24,730	24,746	24,760	24,773	24,786	24,798
Kent	72,344	72,449	72,555	72,610	72,698	72,784	72,866	72,943	73,017	73,088	73,159
Livingston	16,571	16,579	16,596	16,602	16,612	16,621	16,629	16,637	16,645	16,651	16,658
Macomb	99,214	99,294	99,381	99,481	99,549	99,615	99,675	99,732	99,788	99,840	99,890
Monroe	15,253	15,270	15,290	15,304	15,317	15,328	15,340	15,350	15,361	15,370	15,378
Oakland	117,279	117,387	117,495	117,620	117,685	117,745	117,801	117,855	117,902	117,945	117,987
Washtenaw	26,309	26,330	26,350	26,356	26,370	26,384	26,397	26,410	26,422	26,433	26,444
Wayne	163,498	163,620	163,784	163,936	164,067	164,193	164,312	164,424	164,526	164,622	164,716

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:											
	5/24	5/25	5/26	5/27	5/29				5/31				6/2			
Genesee	41,459	41,484	41,508	41,539	41,581	(8,316)	[1,996]	{998}	41,615	(8,323)	[1,998]	{999}	41,647	(8,329)	[1,999]	{1,000}
Ingham	24,649	24,668	24,687	24,697	24,730	(4,946)	[1,187]	{594}	24,760	(4,952)	[1,188]	{594}	24,786	(4,957)	[1,190]	{595}
Kent	72,344	72,449	72,555	72,610	72,784	(14,557)	[3,494]	{1,747}	72,943	(14,589)	[3,501]	{1,751}	73,088	(14,618)	[3,508]	{1,754}
Livingston	16,571	16,579	16,596	16,602	16,621	(3,324)	[798]	{399}	16,637	(3,327)	[799]	{399}	16,651	(3,330)	[799]	{400}
Macomb	99,214	99,294	99,381	99,481	99,615	(19,923)	[4,782]	{2,391}	99,732	(19,946)	[4,787]	{2,394}	99,840	(19,968)	[4,792]	{2,396}
Monroe	15,253	15,270	15,290	15,304	15,328	(3,066)	[736]	{368}	15,350	(3,070)	[737]	{368}	15,370	(3,074)	[738]	{369}
Oakland	117,279	117,387	117,495	117,620	117,745	(23,549)	[5,652]	{2,826}	117,855	(23,571)	[5,657]	{2,829}	117,945	(23,589)	[5,661]	{2,831}
Washtenaw	26,309	26,330	26,350	26,356	26,384	(5,277)	[1,266]	{633}	26,410	(5,282)	[1,268]	{634}	26,433	(5,287)	[1,269]	{634}
Wayne	163,498	163,620	163,784	163,936	164,193	(32,839)	[7,881]	{3,941}	164,424	(32,885)	[7,892]	{3,946}	164,622	(32,924)	[7,902]	{3,951}

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.