

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

Date: 12/20/21

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 12/20/21 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.

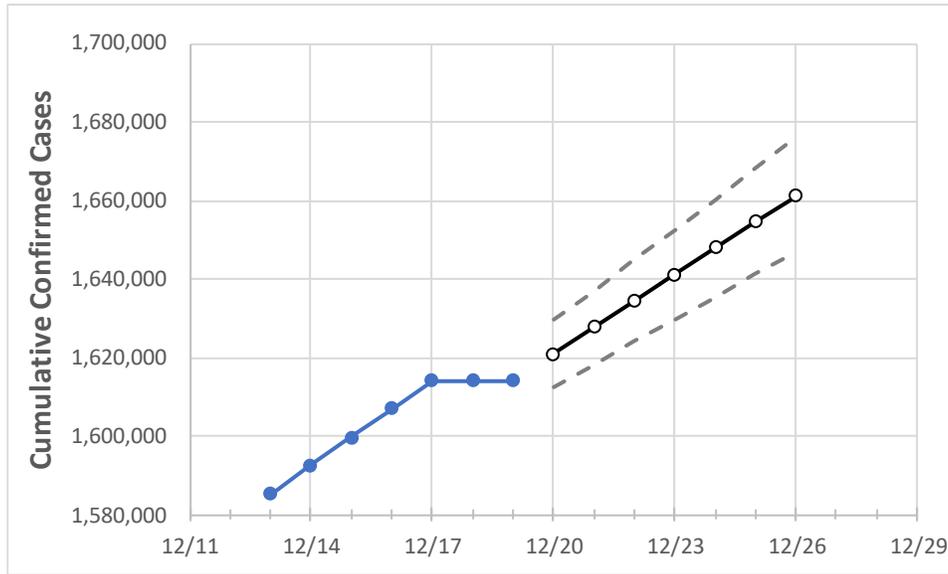
IEM's Modeling Lead

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:							
	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26	
Michigan	1,606,910	1,614,141	1,614,141	1,614,141	1,621,047	1,627,752	1,634,347	1,641,187	1,647,969	1,654,561	1,661,253	

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:							
	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26	
Genesee	68,219	68,584	68,584	68,584	68,979	69,361	69,759	70,151	70,537	70,931	71,327	
Ingham	39,708	39,905	39,905	39,905	40,086	40,262	40,442	40,618	40,792	40,974	41,152	
Kent	117,338	117,724	117,724	117,724	118,077	118,427	118,762	119,101	119,437	119,766	120,091	
Livingston	31,395	31,524	31,524	31,524	31,651	31,782	31,907	32,033	32,159	32,280	32,405	
Macomb	153,097	153,830	153,830	153,830	154,532	155,227	155,914	156,613	157,290	157,989	158,664	
Monroe	25,803	25,935	25,935	25,935	26,056	26,179	26,298	26,418	26,541	26,662	26,784	
Oakland	183,755	184,721	184,721	184,721	185,569	186,420	187,260	188,100	188,937	189,772	190,600	
Washtenaw	42,295	42,501	42,501	42,501	42,693	42,887	43,077	43,269	43,454	43,647	43,834	
Wayne	250,071	251,556	251,556	251,556	252,934	254,329	255,711	257,111	258,550	259,955	261,412	

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:											
	12/16	12/17	12/18	12/19	12/21			12/23			12/25					
Genesee	68,219	68,584	68,584	68,584	69,361	(13,872)	[3,329]	{1,665}	70,151	(14,030)	[3,367]	{1,684}	70,931	(14,186)	[3,405]	{1,702}
Ingham	39,708	39,905	39,905	39,905	40,262	(8,052)	[1,933]	{966}	40,618	(8,124)	[1,950]	{975}	40,974	(8,195)	[1,967]	{983}
Kent	117,338	117,724	117,724	117,724	118,427	(23,685)	[5,684]	{2,842}	119,101	(23,820)	[5,717]	{2,858}	119,766	(23,953)	[5,749]	{2,874}
Livingston	31,395	31,524	31,524	31,524	31,782	(6,356)	[1,526]	{763}	32,033	(6,407)	[1,538]	{769}	32,280	(6,456)	[1,549]	{775}
Macomb	153,097	153,830	153,830	153,830	155,227	(31,045)	[7,451]	{3,725}	156,613	(31,323)	[7,517]	{3,759}	157,989	(31,598)	[7,583]	{3,792}
Monroe	25,803	25,935	25,935	25,935	26,179	(5,236)	[1,257]	{628}	26,418	(5,284)	[1,268]	{634}	26,662	(5,332)	[1,280]	{640}
Oakland	183,755	184,721	184,721	184,721	186,420	(37,284)	[8,948]	{4,474}	188,100	(37,620)	[9,029]	{4,514}	189,772	(37,954)	[9,109]	{4,555}
Washtenaw	42,295	42,501	42,501	42,501	42,887	(8,577)	[2,059]	{1,029}	43,269	(8,654)	[2,077]	{1,038}	43,647	(8,729)	[2,095]	{1,048}
Wayne	250,071	251,556	251,556	251,556	254,329	(50,866)	[12,208]	{6,104}	257,111	(51,422)	[12,341]	{6,171}	259,955	(51,991)	[12,478]	{6,239}

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.