

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

Date: 11/17/21

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 11/17/21 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.

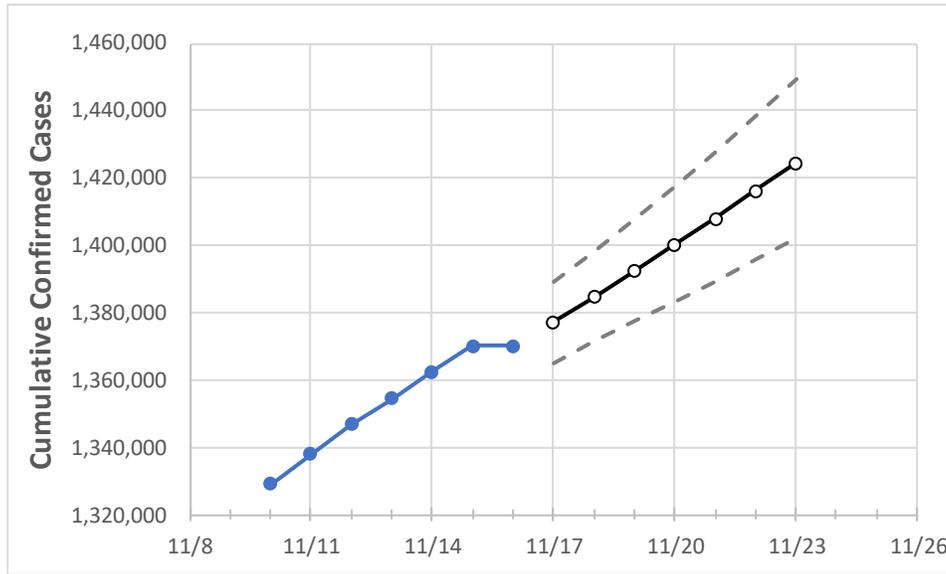
IEM's Modeling Lead

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:						
	11/13	11/14	11/15	11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23
Michigan	1,354,590	1,362,313	1,370,035	1,370,035	1,377,262	1,384,681	1,392,212	1,400,142	1,408,001	1,416,163	1,424,516

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:						
	11/13	11/14	11/15	11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23
Genesee	55,954	56,256	56,558	56,558	56,858	57,160	57,467	57,784	58,107	58,436	58,769
Ingham	33,425	33,662	33,899	33,899	34,133	34,376	34,630	34,894	35,166	35,451	35,741
Kent	100,106	100,723	101,340	101,340	101,860	102,406	102,962	103,522	104,107	104,718	105,318
Livingston	25,496	25,688	25,879	25,879	26,085	26,296	26,509	26,734	26,965	27,203	27,445
Macomb	128,978	129,643	130,309	130,309	130,872	131,479	132,067	132,671	133,278	133,901	134,558
Monroe	22,092	22,233	22,373	22,373	22,508	22,647	22,791	22,938	23,088	23,244	23,403
Oakland	154,933	155,688	156,443	156,443	157,204	157,957	158,751	159,573	160,383	161,236	162,118
Washtenaw	35,552	35,756	35,961	35,961	36,163	36,378	36,594	36,821	37,057	37,301	37,552
Wayne	210,566	211,596	212,627	212,627	213,572	214,555	215,531	216,546	217,613	218,709	219,795

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:											
	11/13	11/14	11/15	11/16	11/18			11/20			11/22					
Genesee	55,954	56,256	56,558	56,558	57,160	(11,432)	[2,744]	{1,372}	57,784	(11,557)	[2,774]	{1,387}	58,436	(11,687)	[2,805]	{1,402}
Ingham	33,425	33,662	33,899	33,899	34,376	(6,875)	[1,650]	{825}	34,894	(6,979)	[1,675]	{837}	35,451	(7,090)	[1,702]	{851}
Kent	100,106	100,723	101,340	101,340	102,406	(20,481)	[4,915]	{2,458}	103,522	(20,704)	[4,969]	{2,485}	104,718	(20,944)	[5,026]	{2,513}
Livingston	25,496	25,688	25,879	25,879	26,296	(5,259)	[1,262]	{631}	26,734	(5,347)	[1,283]	{642}	27,203	(5,441)	[1,306]	{653}
Macomb	128,978	129,643	130,309	130,309	131,479	(26,296)	[6,311]	{3,155}	132,671	(26,534)	[6,368]	{3,184}	133,901	(26,780)	[6,427]	{3,214}
Monroe	22,092	22,233	22,373	22,373	22,647	(4,529)	[1,087]	{544}	22,938	(4,588)	[1,101]	{551}	23,244	(4,649)	[1,116]	{558}
Oakland	154,933	155,688	156,443	156,443	157,957	(31,591)	[7,582]	{3,791}	159,573	(31,915)	[7,659]	{3,830}	161,236	(32,247)	[7,739]	{3,870}
Washtenaw	35,552	35,756	35,961	35,961	36,378	(7,276)	[1,746]	{873}	36,821	(7,364)	[1,767]	{884}	37,301	(7,460)	[1,790]	{895}
Wayne	210,566	211,596	212,627	212,627	214,555	(42,911)	[10,299]	{5,149}	216,546	(43,309)	[10,394]	{5,197}	218,709	(43,742)	[10,498]	{5,249}

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.