

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 11/24/21**

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 11/24/21 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.

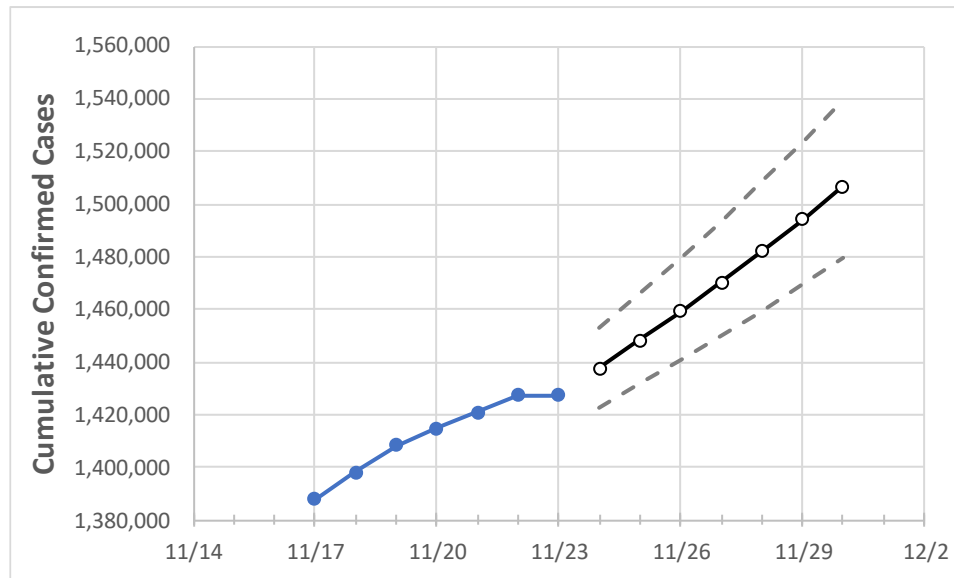
IEM's Modeling Lead

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:						
	11/20	11/21	11/22	11/23	11/24	11/25	11/26	11/27	11/28	11/29	11/30
Michigan	1,414,676	1,420,934	1,427,191	1,427,191	1,437,523	1,448,056	1,459,123	1,470,218	1,482,078	1,494,220	1,506,680

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:						
	11/20	11/21	11/22	11/23	11/24	11/25	11/26	11/27	11/28	11/29	11/30
Genesee	58,504	58,778	59,051	59,051	59,477	59,910	60,353	60,818	61,294	61,780	62,297
Ingham	35,023	35,195	35,366	35,366	35,704	36,047	36,404	36,781	37,168	37,586	38,017
Kent	104,958	105,467	105,975	105,975	106,819	107,663	108,537	109,475	110,412	111,403	112,402
Livingston	26,970	27,116	27,262	27,262	27,517	27,770	28,038	28,307	28,591	28,876	29,173
Macomb	134,132	134,764	135,395	135,395	136,265	137,175	138,102	139,054	140,041	141,088	142,137
Monroe	22,958	23,034	23,111	23,111	23,270	23,428	23,593	23,763	23,935	24,114	24,299
Oakland	161,009	161,717	162,425	162,425	163,499	164,604	165,769	166,951	168,175	169,457	170,817
Washtenaw	37,008	37,163	37,319	37,319	37,572	37,827	38,083	38,351	38,635	38,926	39,228
Wayne	218,978	219,876	220,775	220,775	222,239	223,776	225,340	226,971	228,692	230,450	232,330

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:											
	11/20	11/21	11/22	11/23	11/25			11/27			11/29					
Genesee	58,504	58,778	59,051	59,051	59,910	(11,982)	[2,876]	{1,438}	60,818	(12,164)	[2,919]	{1,460}	61,780	(12,356)	[2,965]	{1,483}
Ingham	35,023	35,195	35,366	35,366	36,047	(7,209)	[1,730]	{865}	36,781	(7,356)	[1,765]	{883}	37,586	(7,517)	[1,804]	{902}
Kent	104,958	105,467	105,975	105,975	107,663	(21,533)	[5,168]	{2,584}	109,475	(21,895)	[5,255]	{2,627}	111,403	(22,281)	[5,347]	{2,674}
Livingston	26,970	27,116	27,262	27,262	27,770	(5,554)	[1,333]	{666}	28,307	(5,661)	[1,359]	{679}	28,876	(5,775)	[1,386]	{693}
Macomb	134,132	134,764	135,395	135,395	137,175	(27,435)	[6,584]	{3,292}	139,054	(27,811)	[6,675]	{3,337}	141,088	(28,218)	[6,772]	{3,386}
Monroe	22,958	23,034	23,111	23,111	23,428	(4,686)	[1,125]	{562}	23,763	(4,753)	[1,141]	{570}	24,114	(4,823)	[1,157]	{579}
Oakland	161,009	161,717	162,425	162,425	164,604	(32,921)	[7,901]	{3,950}	166,951	(33,390)	[8,014]	{4,007}	169,457	(33,891)	[8,134]	{4,067}
Washtenaw	37,008	37,163	37,319	37,319	37,827	(7,565)	[1,816]	{908}	38,351	(7,670)	[1,841]	{920}	38,926	(7,785)	[1,868]	{934}
Wayne	218,978	219,876	220,775	220,775	223,776	(44,755)	[10,741]	{5,371}	226,971	(45,394)	[10,895]	{5,447}	230,450	(46,090)	[11,062]	{5,531}

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.