

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

Date: 1/28/22

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 1/28/22 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.

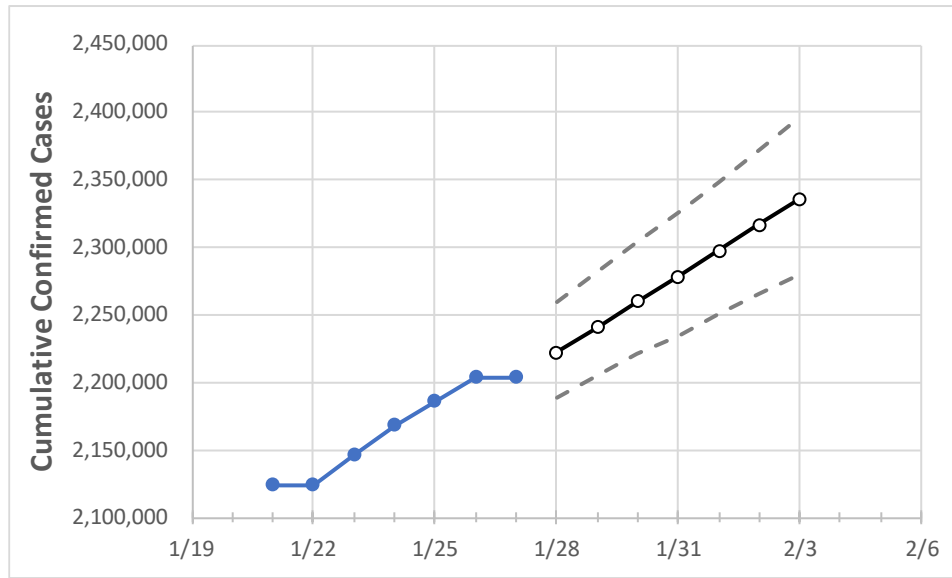
IEM's Modeling Lead

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:							
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3	
Michigan	2,168,367	2,186,007	2,203,646	2,203,646	2,222,559	2,241,023	2,259,898	2,278,448	2,297,941	2,316,784	2,335,762	

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:							
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3	
Genesee	92,689	93,330	93,971	93,971	94,756	95,547	96,314	97,089	97,863	98,628	99,390	
Ingham	57,398	58,057	58,715	58,715	59,410	60,107	60,809	61,506	62,217	62,932	63,648	
Kent	153,298	154,270	155,242	155,242	156,450	157,634	158,823	160,006	161,219	162,426	163,662	
Livingston	42,387	42,756	43,124	43,124	43,561	44,005	44,448	44,901	45,357	45,813	46,266	
Macomb	209,032	210,335	211,638	211,638	212,950	214,228	215,489	216,728	217,963	219,190	220,386	
Monroe	35,212	35,431	35,650	35,650	35,923	36,187	36,455	36,711	36,965	37,227	37,478	
Oakland	258,982	260,968	262,953	262,953	264,848	266,708	268,551	270,349	272,162	273,946	275,729	
Washtenaw	66,057	66,580	67,103	67,103	67,776	68,419	69,073	69,702	70,349	70,984	71,612	
Wayne	363,295	366,088	368,880	368,880	371,517	374,054	376,516	378,990	381,375	383,785	386,141	

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:											
	1/24	1/25	1/26	1/27	1/29		1/31		2/2							
Genesee	92,689	93,330	93,971	93,971	95,547	(19,109)	[4,586]	{2,293}	97,089	(19,418)	[4,660]	{2,330}	98,628	(19,726)	[4,734]	{2,367}
Ingham	57,398	58,057	58,715	58,715	60,107	(12,021)	[2,885]	{1,443}	61,506	(12,301)	[2,952]	{1,476}	62,932	(12,586)	[3,021]	{1,510}
Kent	153,298	154,270	155,242	155,242	157,634	(31,527)	[7,566]	{3,783}	160,006	(32,001)	[7,680]	{3,840}	162,426	(32,485)	[7,796]	{3,898}
Livingston	42,387	42,756	43,124	43,124	44,005	(8,801)	[2,112]	{1,056}	44,901	(8,980)	[2,155]	{1,078}	45,813	(9,163)	[2,199]	{1,100}
Macomb	209,032	210,335	211,638	211,638	214,228	(42,846)	[10,283]	{5,141}	216,728	(43,346)	[10,403]	{5,201}	219,190	(43,838)	[10,521]	{5,261}
Monroe	35,212	35,431	35,650	35,650	36,187	(7,237)	[1,737]	{868}	36,711	(7,342)	[1,762]	{881}	37,227	(7,445)	[1,787]	{893}
Oakland	258,982	260,968	262,953	262,953	266,708	(53,342)	[12,802]	{6,401}	270,349	(54,070)	[12,977]	{6,488}	273,946	(54,789)	[13,149]	{6,575}
Washtenaw	66,057	66,580	67,103	67,103	68,419	(13,684)	[3,284]	{1,642}	69,702	(13,940)	[3,346]	{1,673}	70,984	(14,197)	[3,407]	{1,704}
Wayne	363,295	366,088	368,880	368,880	374,054	(74,811)	[17,955]	{8,977}	378,990	(75,798)	[18,192]	{9,096}	383,785	(76,757)	[18,422]	{9,211}

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.