

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

Date: 1/31/22

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 1/31/22 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.**

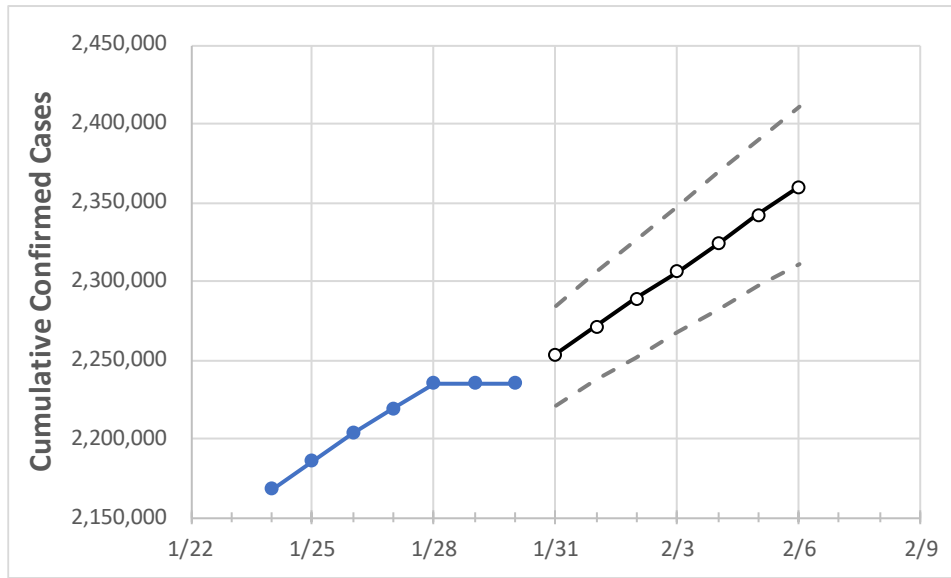
### IEM's Modeling Lead

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:							
	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	
Michigan	2,219,413	2,235,180	2,235,180	2,235,180	2,253,450	2,271,336	2,288,896	2,306,440	2,324,013	2,342,166	2,359,865	

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:							
	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	
Genesee	94,539	95,106	95,106	95,106	95,780	96,455	97,103	97,745	98,383	99,025	99,651	
Ingham	59,077	59,438	59,438	59,438	60,078	60,718	61,346	61,962	62,593	63,223	63,846	
Kent	156,203	157,163	157,163	157,163	158,272	159,355	160,443	161,536	162,613	163,695	164,774	
Livingston	43,357	43,589	43,589	43,589	43,975	44,369	44,747	45,141	45,518	45,916	46,306	
Macomb	212,811	213,984	213,984	213,984	215,157	216,317	217,438	218,530	219,623	220,719	221,763	
Monroe	35,809	35,968	35,968	35,968	36,202	36,430	36,658	36,874	37,088	37,307	37,516	
Oakland	265,256	267,558	267,558	267,558	269,519	271,441	273,383	275,279	277,158	279,074	280,902	
Washtenaw	67,591	68,079	68,079	68,079	68,646	69,189	69,724	70,259	70,780	71,300	71,800	
Wayne	371,604	374,328	374,328	374,328	376,688	379,008	381,249	383,572	385,735	387,946	390,059	

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:											
	1/27	1/28	1/29	1/30	2/1		2/3		2/5							
Genesee	94,539	95,106	95,106	95,106	96,455	(19,291)	[4,630]	{2,315}	97,745	(19,549)	[4,692]	{2,346}	99,025	(19,805)	[4,753]	{2,377}
Ingham	59,077	59,438	59,438	59,438	60,718	(12,144)	[2,914]	{1,457}	61,962	(12,392)	[2,974]	{1,487}	63,223	(12,645)	[3,035]	{1,517}
Kent	156,203	157,163	157,163	157,163	159,355	(31,871)	[7,649]	{3,825}	161,536	(32,307)	[7,754]	{3,877}	163,695	(32,739)	[7,857]	{3,929}
Livingston	43,357	43,589	43,589	43,589	44,369	(8,874)	[2,130]	{1,065}	45,141	(9,028)	[2,167]	{1,083}	45,916	(9,183)	[2,204]	{1,102}
Macomb	212,811	213,984	213,984	213,984	216,317	(43,263)	[10,383]	{5,192}	218,530	(43,706)	[10,489]	{5,245}	220,719	(44,144)	[10,595]	{5,297}
Monroe	35,809	35,968	35,968	35,968	36,430	(7,286)	[1,749]	{874}	36,874	(7,375)	[1,770]	{885}	37,307	(7,461)	[1,791]	{895}
Oakland	265,256	267,558	267,558	267,558	271,441	(54,288)	[13,029]	{6,515}	275,279	(55,056)	[13,213]	{6,607}	279,074	(55,815)	[13,396]	{6,698}
Washtenaw	67,591	68,079	68,079	68,079	69,189	(13,838)	[3,321]	{1,661}	70,259	(14,052)	[3,372]	{1,686}	71,300	(14,260)	[3,422]	{1,711}
Wayne	371,604	374,328	374,328	374,328	379,008	(75,802)	[18,192]	{9,096}	383,572	(76,714)	[18,411]	{9,206}	387,946	(77,589)	[18,621]	{9,311}

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