

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 12/8/21**

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 12/8/21 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.

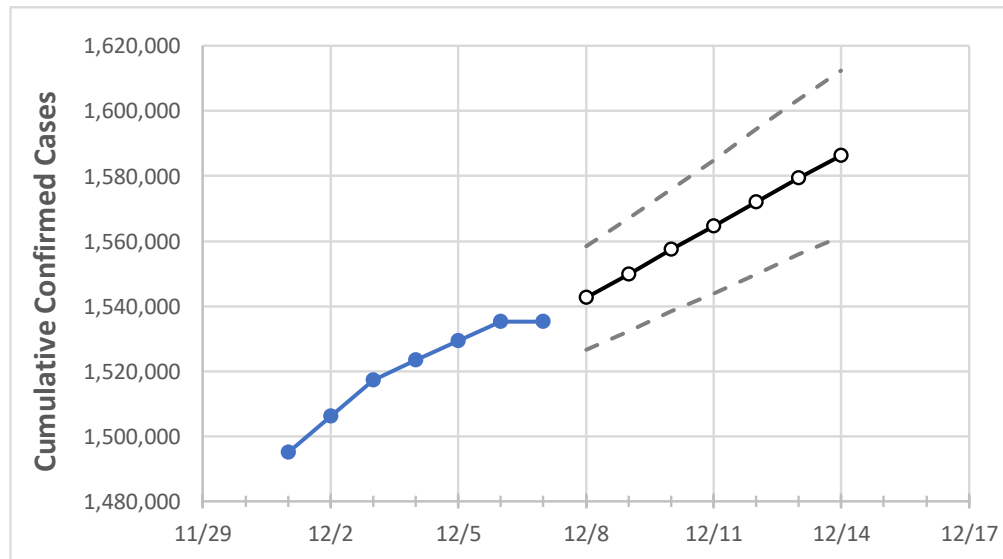
IEM's Modeling Lead

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:					
	12/4	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14
Michigan	1,523,266	1,529,206	1,535,147	1,535,147	1,542,712	1,549,836	1,557,360	1,564,647	1,571,966	1,579,361	1,586,366

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:						
	12/4	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14
Genesee	63,634	63,941	64,247	64,247	64,615	65,003	65,379	65,762	66,149	66,541	66,928
Ingham	37,659	37,813	37,967	37,967	38,141	38,320	38,496	38,664	38,842	39,016	39,188
Kent	112,526	112,901	113,275	113,275	113,748	114,213	114,641	115,109	115,555	115,986	116,424
Livingston	29,626	29,748	29,871	29,871	30,042	30,214	30,379	30,545	30,713	30,880	31,041
Macomb	144,588	145,249	145,911	145,911	146,658	147,438	148,182	148,954	149,718	150,518	151,261
Monroe	24,484	24,563	24,641	24,641	24,740	24,844	24,947	25,047	25,146	25,251	25,349
Oakland	173,827	174,504	175,182	175,182	176,070	177,006	177,928	178,850	179,792	180,736	181,688
Washtenaw	39,911	40,093	40,274	40,274	40,494	40,709	40,931	41,155	41,381	41,610	41,829
Wayne	235,253	236,195	237,136	237,136	238,301	239,447	240,621	241,803	243,005	244,207	245,331

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:											
	12/4	12/5	12/6	12/7	12/9				12/11				12/13			
Genesee	63,634	63,941	64,247	64,247	65,003	(13,001)	[3,120]	{1,560}	65,762	(13,152)	[3,157]	{1,578}	66,541	(13,308)	[3,194]	{1,597}
Ingham	37,659	37,813	37,967	37,967	38,320	(7,664)	[1,839]	{920}	38,664	(7,733)	[1,856]	{928}	39,016	(7,803)	[1,873]	{936}
Kent	112,526	112,901	113,275	113,275	114,213	(22,843)	[5,482]	{2,741}	115,109	(23,022)	[5,525]	{2,763}	115,986	(23,197)	[5,567]	{2,784}
Livingston	29,626	29,748	29,871	29,871	30,214	(6,043)	[1,450]	{725}	30,545	(6,109)	[1,466]	{733}	30,880	(6,176)	[1,482]	{741}
Macomb	144,588	145,249	145,911	145,911	147,438	(29,488)	[7,077]	{3,539}	148,954	(29,791)	[7,150]	{3,575}	150,518	(30,104)	[7,225]	{3,612}
Monroe	24,484	24,563	24,641	24,641	24,844	(4,969)	[1,192]	{596}	25,047	(5,009)	[1,202]	{601}	25,251	(5,050)	[1,212]	{606}
Oakland	173,827	174,504	175,182	175,182	177,006	(35,401)	[8,496]	{4,248}	178,850	(35,770)	[8,585]	{4,292}	180,736	(36,147)	[8,675]	{4,338}
Washtenaw	39,911	40,093	40,274	40,274	40,709	(8,142)	[1,954]	{977}	41,155	(8,231)	[1,975]	{988}	41,610	(8,322)	[1,997]	{999}
Wayne	235,253	236,195	237,136	237,136	239,447	(47,889)	[11,493]	{5,747}	241,803	(48,361)	[11,607]	{5,803}	244,207	(48,841)	[11,722]	{5,861}

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.