

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 12/15/21**

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 12/15/21 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.

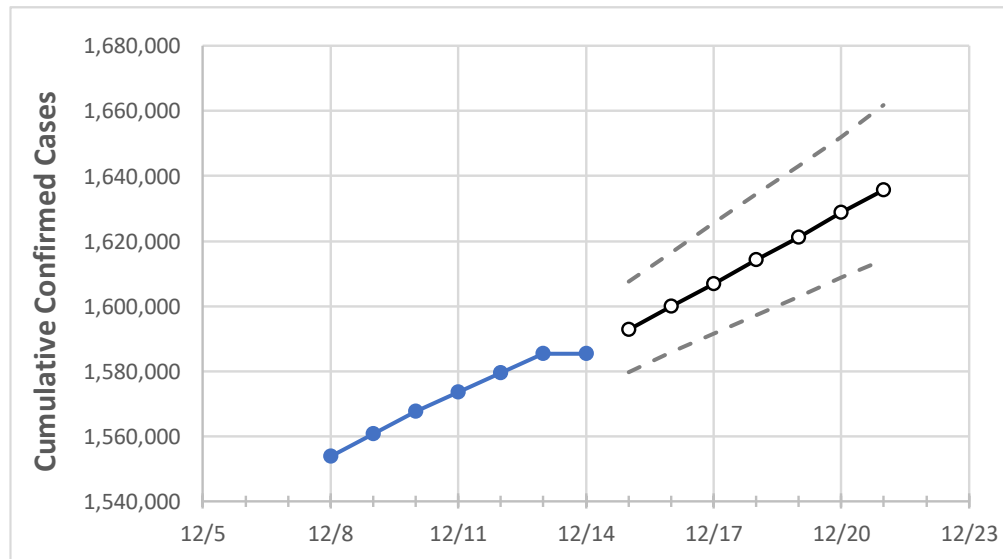
IEM's Modeling Lead

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:						
	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21
Michigan	1,573,484	1,579,391	1,585,297	1,585,297	1,592,656	1,599,835	1,606,920	1,614,288	1,621,144	1,628,637	1,635,585

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:						
	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21
Genesee	66,445	66,755	67,065	67,065	67,502	67,948	68,366	68,804	69,259	69,716	70,172
Ingham	38,834	38,973	39,111	39,111	39,281	39,453	39,625	39,801	39,967	40,145	40,318
Kent	115,467	115,815	116,164	116,164	116,571	116,967	117,360	117,739	118,119	118,513	118,877
Livingston	30,718	30,835	30,951	30,951	31,104	31,249	31,398	31,543	31,680	31,828	31,968
Macomb	149,693	150,298	150,902	150,902	151,625	152,340	153,055	153,769	154,499	155,213	155,929
Monroe	25,230	25,321	25,413	25,413	25,530	25,639	25,755	25,874	25,986	26,105	26,221
Oakland	179,731	180,384	181,037	181,037	181,872	182,719	183,574	184,393	185,244	186,071	186,901
Washtenaw	41,371	41,556	41,742	41,742	41,963	42,183	42,402	42,619	42,833	43,061	43,278
Wayne	243,628	244,700	245,773	245,773	247,008	248,272	249,489	250,744	252,009	253,253	254,536

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:											
	12/11	12/12	12/13	12/14	12/16			12/18			12/20					
Genesee	66,445	66,755	67,065	67,065	67,948	(13,590)	[3,262]	{1,631}	68,804	(13,761)	[3,303]	{1,651}	69,716	(13,943)	[3,346]	{1,673}
Ingham	38,834	38,973	39,111	39,111	39,453	(7,891)	[1,894]	{947}	39,801	(7,960)	[1,910]	{955}	40,145	(8,029)	[1,927]	{963}
Kent	115,467	115,815	116,164	116,164	116,967	(23,393)	[5,614]	{2,807}	117,739	(23,548)	[5,651]	{2,826}	118,513	(23,703)	[5,689]	{2,844}
Livingston	30,718	30,835	30,951	30,951	31,249	(6,250)	[1,500]	{750}	31,543	(6,309)	[1,514]	{757}	31,828	(6,366)	[1,528]	{764}
Macomb	149,693	150,298	150,902	150,902	152,340	(30,468)	[7,312]	{3,656}	153,769	(30,754)	[7,381]	{3,690}	155,213	(31,043)	[7,450]	{3,725}
Monroe	25,230	25,321	25,413	25,413	25,639	(5,128)	[1,231]	{615}	25,874	(5,175)	[1,242]	{621}	26,105	(5,221)	[1,253]	{627}
Oakland	179,731	180,384	181,037	181,037	182,719	(36,544)	[8,771]	{4,385}	184,393	(36,879)	[8,851]	{4,425}	186,071	(37,214)	[8,931]	{4,466}
Washtenaw	41,371	41,556	41,742	41,742	42,183	(8,437)	[2,025]	{1,012}	42,619	(8,524)	[2,046]	{1,023}	43,061	(8,612)	[2,067]	{1,033}
Wayne	243,628	244,700	245,773	245,773	248,272	(49,654)	[11,917]	{5,959}	250,744	(50,149)	[12,036]	{6,018}	253,253	(50,651)	[12,156]	{6,078}

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.