

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 12/10/21**

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 12/10/21 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.

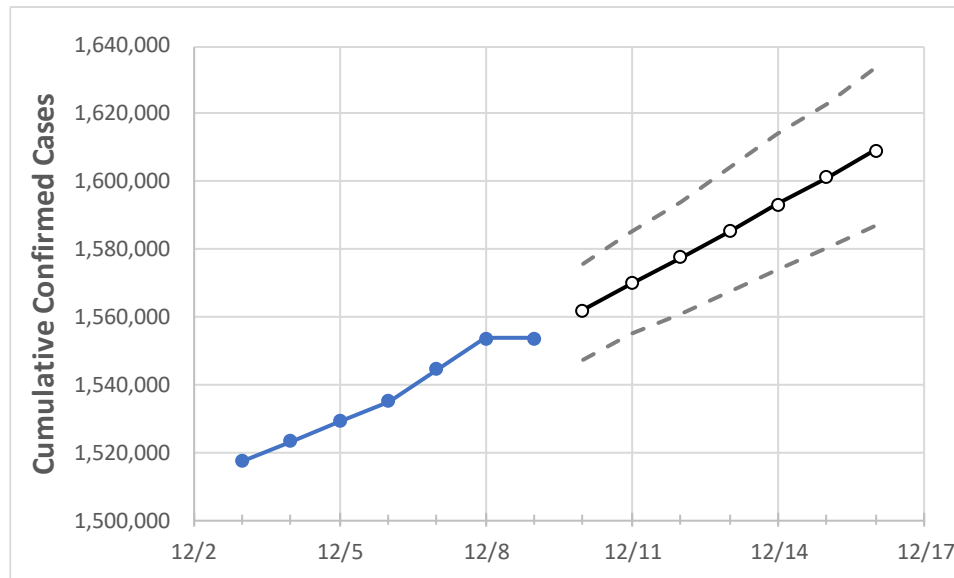
IEM's Modeling Lead

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:					
	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14	12/15	12/16
Michigan	1,535,147	1,544,469	1,553,790	1,553,790	1,561,898	1,569,888	1,577,675	1,585,406	1,593,239	1,601,344	1,609,285

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:						
	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14	12/15	12/16
Genesee	64,247	64,799	65,350	65,350	65,769	66,198	66,629	67,052	67,504	67,946	68,395
Ingham	37,967	38,186	38,405	38,405	38,587	38,775	38,955	39,138	39,325	39,516	39,699
Kent	113,275	113,774	114,273	114,273	114,727	115,191	115,643	116,096	116,532	117,012	117,435
Livingston	29,871	30,060	30,249	30,249	30,416	30,591	30,762	30,924	31,097	31,264	31,436
Macomb	145,911	146,845	147,778	147,778	148,585	149,419	150,247	151,071	151,919	152,765	153,619
Monroe	24,641	24,802	24,962	24,962	25,075	25,191	25,304	25,419	25,536	25,651	25,764
Oakland	175,182	176,284	177,385	177,385	178,344	179,295	180,276	181,261	182,223	183,244	184,235
Washtenaw	40,274	40,536	40,798	40,798	41,030	41,265	41,499	41,733	41,975	42,225	42,474
Wayne	237,136	238,767	240,397	240,397	241,692	242,992	244,335	245,675	246,973	248,355	249,678

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:											
	12/6	12/7	12/8	12/9	12/11				12/13				12/15			
Genesee	64,247	64,799	65,350	65,350	66,198	(13,240)	[3,178]	{1,589}	67,052	(13,410)	[3,218]	{1,609}	67,946	(13,589)	[3,261]	{1,631}
Ingham	37,967	38,186	38,405	38,405	38,775	(7,755)	[1,861]	{931}	39,138	(7,828)	[1,879]	{939}	39,516	(7,903)	[1,897]	{948}
Kent	113,275	113,774	114,273	114,273	115,191	(23,038)	[5,529]	{2,765}	116,096	(23,219)	[5,573]	{2,786}	117,012	(23,402)	[5,617]	{2,808}
Livingston	29,871	30,060	30,249	30,249	30,591	(6,118)	[1,468]	{734}	30,924	(6,185)	[1,484]	{742}	31,264	(6,253)	[1,501]	{750}
Macomb	145,911	146,845	147,778	147,778	149,419	(29,884)	[7,172]	{3,586}	151,071	(30,214)	[7,251]	{3,626}	152,765	(30,553)	[7,333]	{3,666}
Monroe	24,641	24,802	24,962	24,962	25,191	(5,038)	[1,209]	{605}	25,419	(5,084)	[1,220]	{610}	25,651	(5,130)	[1,231]	{616}
Oakland	175,182	176,284	177,385	177,385	179,295	(35,859)	[8,606]	{4,303}	181,261	(36,252)	[8,701]	{4,350}	183,244	(36,649)	[8,796]	{4,398}
Washtenaw	40,274	40,536	40,798	40,798	41,265	(8,253)	[1,981]	{990}	41,733	(8,347)	[2,003]	{1,002}	42,225	(8,445)	[2,027]	{1,013}
Wayne	237,136	238,767	240,397	240,397	242,992	(48,598)	[11,664]	{5,832}	245,675	(49,135)	[11,792]	{5,896}	248,355	(49,671)	[11,921]	{5,961}

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.