

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

Date: 1/6/21

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 1/6/21 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.

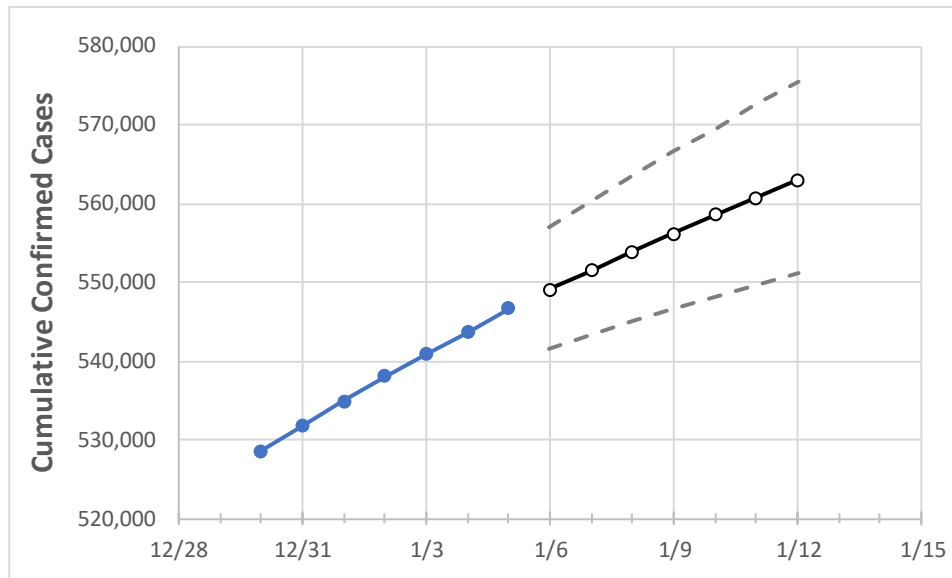
IEM's Modeling Lead

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:						
	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12
Michigan	538,121	540,866	543,611	546,642	549,133	551,523	553,871	556,218	558,536	560,769	563,015

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:						
	1/2	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12
Genesee	21,821	21,912	22,003	22,100	22,164	22,226	22,283	22,339	22,390	22,439	22,485
Ingham	12,880	12,956	13,032	13,109	13,178	13,247	13,314	13,381	13,446	13,511	13,575
Kent	44,054	44,217	44,380	44,675	44,871	45,066	45,257	45,452	45,643	45,835	46,022
Livingston	7,998	8,070	8,142	8,214	8,262	8,310	8,357	8,404	8,450	8,495	8,541
Macomb	50,124	50,356	50,588	50,755	50,906	51,053	51,194	51,331	51,459	51,587	51,711
Monroe	7,808	7,860	7,912	7,992	8,042	8,093	8,144	8,195	8,246	8,296	8,347
Oakland	62,094	62,460	62,826	63,188	63,469	63,744	64,016	64,283	64,543	64,807	65,056
Washtenaw	13,959	14,054	14,148	14,263	14,331	14,397	14,466	14,528	14,593	14,655	14,715
Wayne	85,996	86,437	86,878	87,259	87,577	87,880	88,174	88,456	88,731	88,999	89,261

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:											
	1/2	1/3	1/4	1/5	1/7				1/9				1/11			
Genesee	21,821	21,912	22,003	22,100	22,226	(4,445)	[1,067]	{533}	22,339	(4,468)	[1,072]	{536}	22,439	(4,488)	[1,077]	{539}
Ingham	12,880	12,956	13,032	13,109	13,247	(2,649)	[636]	{318}	13,381	(2,676)	[642]	{321}	13,511	(2,702)	[649]	{324}
Kent	44,054	44,217	44,380	44,675	45,066	(9,013)	[2,163]	{1,082}	45,452	(9,090)	[2,182]	{1,091}	45,835	(9,167)	[2,200]	{1,100}
Livingston	7,998	8,070	8,142	8,214	8,310	(1,662)	[399]	{199}	8,404	(1,681)	[403]	{202}	8,495	(1,699)	[408]	{204}
Macomb	50,124	50,356	50,588	50,755	51,053	(10,211)	[2,451]	{1,225}	51,331	(10,266)	[2,464]	{1,232}	51,587	(10,317)	[2,476]	{1,238}
Monroe	7,808	7,860	7,912	7,992	8,093	(1,619)	[388]	{194}	8,195	(1,639)	[393]	{197}	8,296	(1,659)	[398]	{199}
Oakland	62,094	62,460	62,826	63,188	63,744	(12,749)	[3,060]	{1,530}	64,283	(12,857)	[3,086]	{1,543}	64,807	(12,961)	[3,111]	{1,555}
Washtenaw	13,959	14,054	14,148	14,263	14,397	(2,879)	[691]	{346}	14,528	(2,906)	[697]	{349}	14,655	(2,931)	[703]	{352}
Wayne	85,996	86,437	86,878	87,259	87,880	(17,576)	[4,218]	{2,109}	88,456	(17,691)	[4,246]	{2,123}	88,999	(17,800)	[4,272]	{2,136}

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.