

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

Date: 2/17/21

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 2/17/21 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.

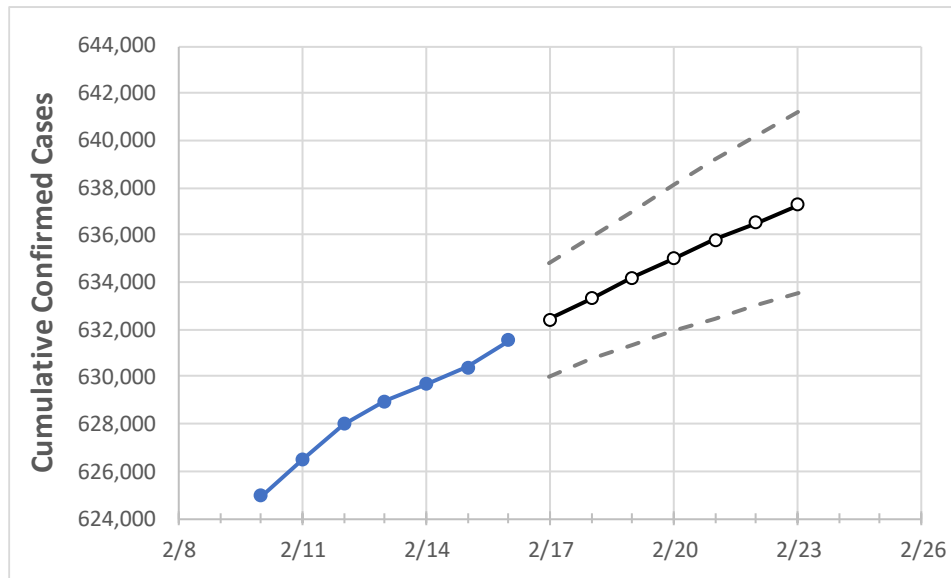
IEM's Modeling Lead

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:						
	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23
Michigan	628,956	629,682	630,408	631,532	632,444	633,313	634,177	634,979	635,786	636,536	637,261

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:						
	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23
Genesee	24,899	24,920	24,941	24,975	25,003	25,031	25,057	25,083	25,108	25,133	25,156
Ingham	15,846	15,865	15,883	15,935	15,974	16,014	16,053	16,087	16,122	16,156	16,190
Kent	50,599	50,665	50,730	50,808	50,880	50,953	51,025	51,094	51,159	51,223	51,287
Livingston	9,986	10,002	10,017	10,037	10,052	10,067	10,081	10,094	10,108	10,120	10,131
Macomb	57,395	57,446	57,496	57,577	57,647	57,715	57,780	57,841	57,901	57,958	58,012
Monroe	9,490	9,503	9,516	9,533	9,547	9,561	9,575	9,587	9,599	9,611	9,622
Oakland	72,810	72,899	72,987	73,116	73,225	73,329	73,427	73,519	73,610	73,698	73,781
Washtenaw	17,889	17,936	17,982	18,016	18,074	18,128	18,181	18,235	18,287	18,335	18,386
Wayne	99,289	99,402	99,515	99,697	99,828	99,954	100,074	100,190	100,300	100,407	100,513

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:											
	2/13	2/14	2/15	2/16	2/18				2/20				2/22			
Genesee	24,899	24,920	24,941	24,975	25,031	(5,006)	[1,201]	{601}	25,083	(5,017)	[1,204]	{602}	25,133	(5,027)	[1,206]	{603}
Ingham	15,846	15,865	15,883	15,935	16,014	(3,203)	[769]	{384}	16,087	(3,217)	[772]	{386}	16,156	(3,231)	[775]	{388}
Kent	50,599	50,665	50,730	50,808	50,953	(10,191)	[2,446]	{1,223}	51,094	(10,219)	[2,452]	{1,226}	51,223	(10,245)	[2,459]	{1,229}
Livingston	9,986	10,002	10,017	10,037	10,067	(2,013)	[483]	{242}	10,094	(2,019)	[485]	{242}	10,120	(2,024)	[486]	{243}
Macomb	57,395	57,446	57,496	57,577	57,715	(11,543)	[2,770]	{1,385}	57,841	(11,568)	[2,776]	{1,388}	57,958	(11,592)	[2,782]	{1,391}
Monroe	9,490	9,503	9,516	9,533	9,561	(1,912)	[459]	{229}	9,587	(1,917)	[460]	{230}	9,611	(1,922)	[461]	{231}
Oakland	72,810	72,899	72,987	73,116	73,329	(14,666)	[3,520]	{1,760}	73,519	(14,704)	[3,529]	{1,764}	73,698	(14,740)	[3,537]	{1,769}
Washtenaw	17,889	17,936	17,982	18,016	18,128	(3,626)	[870]	{435}	18,235	(3,647)	[875]	{438}	18,335	(3,667)	[880]	{440}
Wayne	99,289	99,402	99,515	99,697	99,954	(19,991)	[4,798]	{2,399}	100,190	(20,038)	[4,809]	{2,405}	100,407	(20,081)	[4,820]	{2,410}

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.