

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

Date: 2/25/22

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 2/25/22 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.

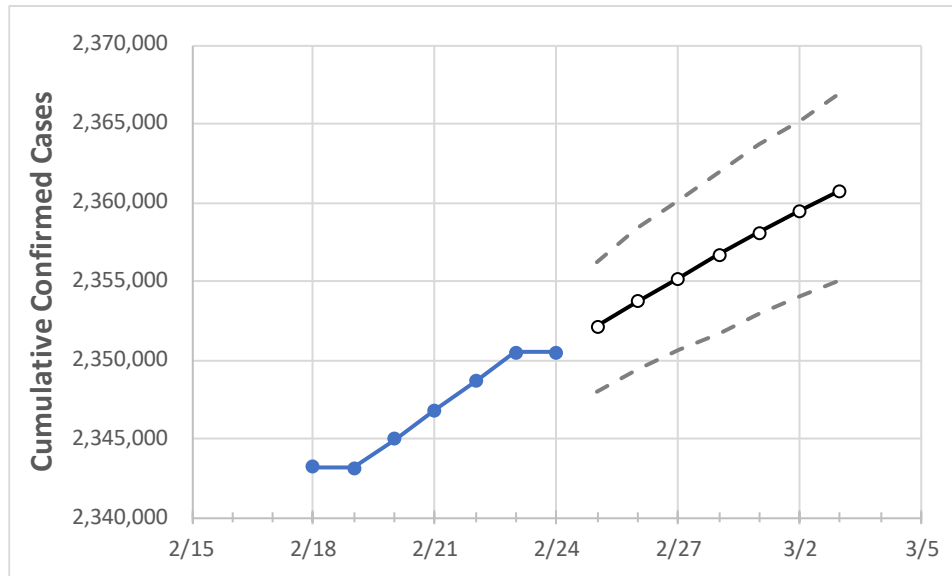
IEM's Modeling Lead

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:						
	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2	3/3
Michigan	2,346,815	2,348,642	2,350,468	2,350,468	2,352,147	2,353,705	2,355,201	2,356,667	2,358,085	2,359,474	2,360,711

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:						
	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2	3/3
Genesee	99,652	99,695	99,738	99,738	99,807	99,869	99,926	99,983	100,042	100,095	100,144
Ingham	62,667	62,711	62,755	62,755	62,802	62,842	62,884	62,922	62,960	62,996	63,028
Kent	163,765	163,852	163,939	163,939	164,021	164,100	164,174	164,242	164,312	164,375	164,435
Livingston	45,072	45,098	45,123	45,123	45,152	45,184	45,212	45,241	45,269	45,294	45,320
Macomb	223,389	223,541	223,693	223,693	223,824	223,951	224,072	224,191	224,305	224,417	224,520
Monroe	37,429	37,447	37,466	37,466	37,486	37,505	37,523	37,540	37,556	37,572	37,586
Oakland	280,736	280,896	281,057	281,057	281,255	281,445	281,619	281,798	281,957	282,114	282,260
Washtenaw	72,118	72,192	72,267	72,267	72,356	72,439	72,526	72,604	72,682	72,756	72,831
Wayne	390,677	390,856	391,035	391,035	391,195	391,340	391,485	391,623	391,748	391,873	391,986

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:											
	2/21	2/22	2/23	2/24	2/26		2/28		3/2							
Genesee	99,652	99,695	99,738	99,738	99,869	(19,974)	[4,794]	{2,397}	99,983	(19,997)	[4,799]	{2,400}	100,095	(20,019)	[4,805]	{2,402}
Ingham	62,667	62,711	62,755	62,755	62,842	(12,568)	[3,016]	{1,508}	62,922	(12,584)	[3,020]	{1,510}	62,996	(12,599)	[3,024]	{1,512}
Kent	163,765	163,852	163,939	163,939	164,100	(32,820)	[7,877]	{3,938}	164,242	(32,848)	[7,884]	{3,942}	164,375	(32,875)	[7,890]	{3,945}
Livingston	45,072	45,098	45,123	45,123	45,184	(9,037)	[2,169]	{1,084}	45,241	(9,048)	[2,172]	{1,086}	45,294	(9,059)	[2,174]	{1,087}
Macomb	223,389	223,541	223,693	223,693	223,951	(44,790)	[10,750]	{5,375}	224,191	(44,838)	[10,761]	{5,381}	224,417	(44,883)	[10,772]	{5,386}
Monroe	37,429	37,447	37,466	37,466	37,505	(7,501)	[1,800]	{900}	37,540	(7,508)	[1,802]	{901}	37,572	(7,514)	[1,803]	{902}
Oakland	280,736	280,896	281,057	281,057	281,445	(56,289)	[13,509]	{6,755}	281,798	(56,360)	[13,526]	{6,763}	282,114	(56,423)	[13,541]	{6,771}
Washtenaw	72,118	72,192	72,267	72,267	72,439	(14,488)	[3,477]	{1,739}	72,604	(14,521)	[3,485]	{1,742}	72,756	(14,551)	[3,492]	{1,746}
Wayne	390,677	390,856	391,035	391,035	391,340	(78,268)	[18,784]	{9,392}	391,623	(78,325)	[18,798]	{9,399}	391,873	(78,375)	[18,810]	{9,405}

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.