

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

Date: 5/21/21

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 5/21/21 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.

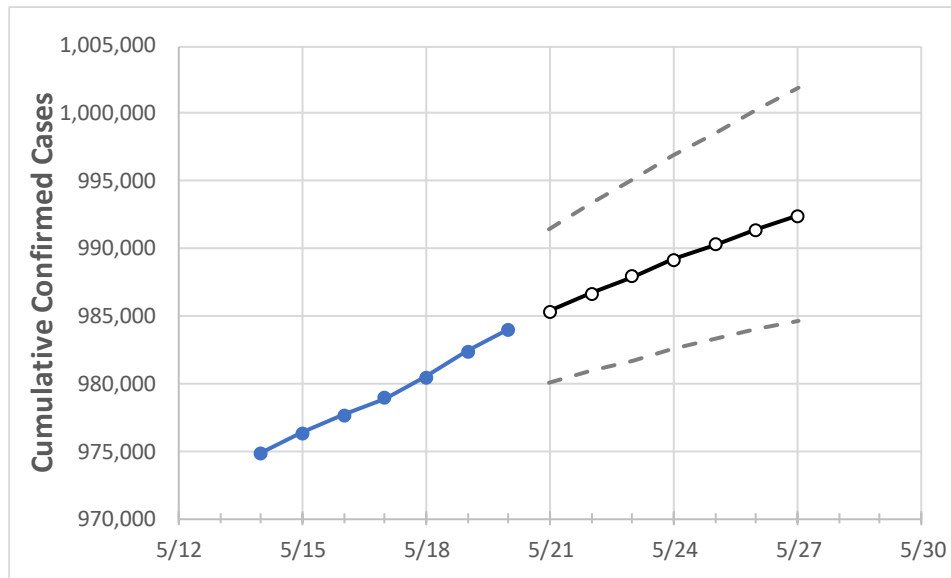
IEM's Modeling Lead

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:						
	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25	5/26	5/27
Michigan	978,915	980,450	982,400	983,970	985,341	986,683	987,954	989,170	990,300	991,400	992,429

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:						
	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25	5/26	5/27
Genesee	41,174	41,231	41,267	41,346	41,384	41,422	41,455	41,488	41,518	41,547	41,575
Ingham	24,452	24,478	24,535	24,577	24,609	24,640	24,670	24,699	24,726	24,753	24,779
Kent	71,502	71,623	71,761	71,861	71,979	72,090	72,198	72,298	72,399	72,496	72,590
Livingston	16,448	16,466	16,491	16,516	16,534	16,550	16,566	16,581	16,595	16,608	16,619
Macomb	98,454	98,549	98,730	98,887	98,994	99,092	99,189	99,276	99,363	99,445	99,521
Monroe	15,131	15,147	15,169	15,198	15,215	15,230	15,245	15,260	15,274	15,286	15,297
Oakland	116,407	116,550	116,794	116,930	117,115	117,296	117,463	117,628	117,786	117,938	118,081
Washtenaw	26,147	26,165	26,213	26,230	26,255	26,277	26,300	26,320	26,341	26,360	26,377
Wayne	162,008	162,225	162,486	162,760	162,972	163,170	163,357	163,536	163,705	163,865	164,015

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:											
	5/17	5/18	5/19	5/20	5/22				5/24				5/26			
Genesee	41,174	41,231	41,267	41,346	41,422	(8,284)	[1,988]	{994}	41,488	(8,298)	[1,991]	{996}	41,547	(8,309)	[1,994]	{997}
Ingham	24,452	24,478	24,535	24,577	24,640	(4,928)	[1,183]	{591}	24,699	(4,940)	[1,186]	{593}	24,753	(4,951)	[1,188]	{594}
Kent	71,502	71,623	71,761	71,861	72,090	(14,418)	[3,460]	{1,730}	72,298	(14,460)	[3,470]	{1,735}	72,496	(14,499)	[3,480]	{1,740}
Livingston	16,448	16,466	16,491	16,516	16,550	(3,310)	[794]	{397}	16,581	(3,316)	[796]	{398}	16,608	(3,322)	[797]	{399}
Macomb	98,454	98,549	98,730	98,887	99,092	(19,818)	[4,756]	{2,378}	99,276	(19,855)	[4,765]	{2,383}	99,445	(19,889)	[4,773]	{2,387}
Monroe	15,131	15,147	15,169	15,198	15,230	(3,046)	[731]	{366}	15,260	(3,052)	[732]	{366}	15,286	(3,057)	[734]	{367}
Oakland	116,407	116,550	116,794	116,930	117,296	(23,459)	[5,630]	{2,815}	117,628	(23,526)	[5,646]	{2,823}	117,938	(23,588)	[5,661]	{2,831}
Washtenaw	26,147	26,165	26,213	26,230	26,277	(5,255)	[1,261]	{631}	26,320	(5,264)	[1,263]	{632}	26,360	(5,272)	[1,265]	{633}
Wayne	162,008	162,225	162,486	162,760	163,170	(32,634)	[7,832]	{3,916}	163,536	(32,707)	[7,850]	{3,925}	163,865	(32,773)	[7,866]	{3,933}

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.