

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

Date: 5/12/21

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 5/12/21 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.

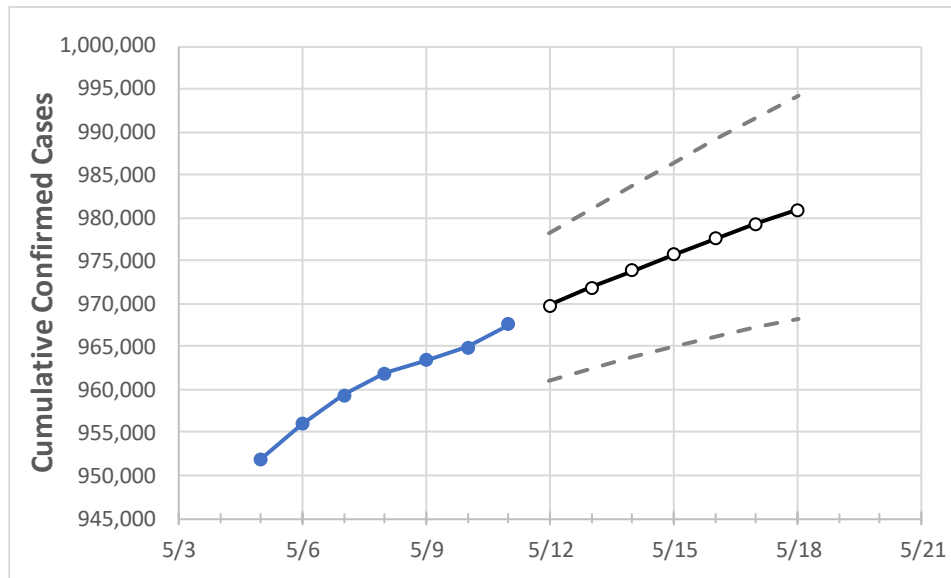
IEM's Modeling Lead

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:						
	5/8	5/9	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18
Michigan	961,956	963,450	964,943	967,611	969,774	971,850	973,872	975,745	977,607	979,331	980,962

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:							
	5/8	5/9	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18	
Genesee	40,639	40,684	40,729	40,816	40,900	40,978	41,052	41,122	41,186	41,247	41,303	
Ingham	24,100	24,140	24,180	24,213	24,250	24,285	24,318	24,349	24,380	24,408	24,435	
Kent	70,012	70,138	70,263	70,477	70,646	70,809	70,969	71,116	71,263	71,399	71,532	
Livingston	16,194	16,218	16,241	16,270	16,302	16,332	16,360	16,386	16,411	16,434	16,455	
Macomb	97,068	97,193	97,317	97,499	97,684	97,857	98,020	98,173	98,317	98,453	98,583	
Monroe	14,912	14,942	14,972	14,998	15,031	15,064	15,096	15,126	15,155	15,182	15,208	
Oakland	114,310	114,436	114,561	115,013	115,294	115,575	115,834	116,084	116,321	116,556	116,784	
Washtenaw	25,836	25,861	25,885	25,920	25,955	25,988	26,020	26,049	26,077	26,102	26,128	
Wayne	159,167	159,456	159,745	160,161	160,520	160,857	161,174	161,477	161,773	162,040	162,293	

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:											
	5/8	5/9	5/10	5/11	5/13				5/15				5/17			
Genesee	40,639	40,684	40,729	40,816	40,978	(8,196)	[1,967]	{983}	41,122	(8,224)	[1,974]	{987}	41,247	(8,249)	[1,980]	{990}
Ingham	24,100	24,140	24,180	24,213	24,285	(4,857)	[1,166]	{583}	24,349	(4,870)	[1,169]	{584}	24,408	(4,882)	[1,172]	{586}
Kent	70,012	70,138	70,263	70,477	70,809	(14,162)	[3,399]	{1,699}	71,116	(14,223)	[3,414]	{1,707}	71,399	(14,280)	[3,427]	{1,714}
Livingston	16,194	16,218	16,241	16,270	16,332	(3,266)	[784]	{392}	16,386	(3,277)	[787]	{393}	16,434	(3,287)	[789]	{394}
Macomb	97,068	97,193	97,317	97,499	97,857	(19,571)	[4,697]	{2,349}	98,173	(19,635)	[4,712]	{2,356}	98,453	(19,691)	[4,726]	{2,363}
Monroe	14,912	14,942	14,972	14,998	15,064	(3,013)	[723]	{362}	15,126	(3,025)	[726]	{363}	15,182	(3,036)	[729]	{364}
Oakland	114,310	114,436	114,561	115,013	115,575	(23,115)	[5,548]	{2,774}	116,084	(23,217)	[5,572]	{2,786}	116,556	(23,311)	[5,595]	{2,797}
Washtenaw	25,836	25,861	25,885	25,920	25,988	(5,198)	[1,247]	{624}	26,049	(5,210)	[1,250]	{625}	26,102	(5,220)	[1,253]	{626}
Wayne	159,167	159,456	159,745	160,161	160,857	(32,171)	[7,721]	{3,861}	161,477	(32,295)	[7,751]	{3,875}	162,040	(32,408)	[7,778]	{3,889}

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.