

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

Date: 5/14/21

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 5/14/21 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.

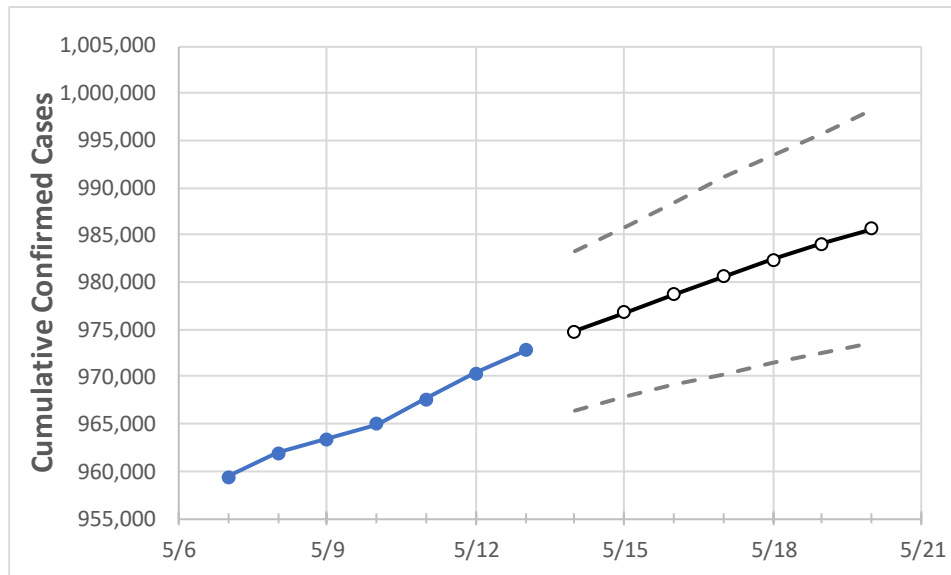
IEM's Modeling Lead

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:							
	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18	5/19	5/20	
Michigan	964,943	967,611	970,376	972,746	974,753	976,756	978,722	980,566	982,363	984,036	985,671	

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:							
	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18	5/19	5/20	
Genesee	40,729	40,816	40,910	41,001	41,077	41,145	41,210	41,272	41,330	41,385	41,436	
Ingham	24,180	24,213	24,258	24,310	24,346	24,380	24,413	24,445	24,474	24,503	24,530	
Kent	70,263	70,477	70,722	70,896	71,059	71,220	71,376	71,525	71,668	71,807	71,938	
Livingston	16,241	16,270	16,321	16,358	16,388	16,416	16,443	16,467	16,491	16,513	16,534	
Macomb	97,317	97,499	97,722	97,927	98,101	98,264	98,423	98,573	98,717	98,852	98,980	
Monroe	14,972	14,998	15,032	15,045	15,073	15,101	15,127	15,152	15,177	15,200	15,221	
Oakland	114,561	115,013	115,381	115,741	116,026	116,296	116,555	116,808	117,058	117,302	117,533	
Washtenaw	25,885	25,920	26,001	26,039	26,074	26,109	26,141	26,171	26,202	26,231	26,260	
Wayne	159,745	160,161	160,583	160,985	161,324	161,648	161,958	162,244	162,535	162,806	163,062	

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:											
	5/10	5/11	5/12	5/13	5/15				5/17				5/19			
Genesee	40,729	40,816	40,910	41,001	41,145	(8,229)	[1,975]	{987}	41,272	(8,254)	[1,981]	{991}	41,385	(8,277)	[1,987]	{993}
Ingham	24,180	24,213	24,258	24,310	24,380	(4,876)	[1,170]	{585}	24,445	(4,889)	[1,173]	{587}	24,503	(4,901)	[1,176]	{588}
Kent	70,263	70,477	70,722	70,896	71,220	(14,244)	[3,419]	{1,709}	71,525	(14,305)	[3,433]	{1,717}	71,807	(14,361)	[3,447]	{1,723}
Livingston	16,241	16,270	16,321	16,358	16,416	(3,283)	[788]	{394}	16,467	(3,293)	[790]	{395}	16,513	(3,303)	[793]	{396}
Macomb	97,317	97,499	97,722	97,927	98,264	(19,653)	[4,717]	{2,358}	98,573	(19,715)	[4,731]	{2,366}	98,852	(19,770)	[4,745]	{2,372}
Monroe	14,972	14,998	15,032	15,045	15,101	(3,020)	[725]	{362}	15,152	(3,030)	[727]	{364}	15,200	(3,040)	[730]	{365}
Oakland	114,561	115,013	115,381	115,741	116,296	(23,259)	[5,582]	{2,791}	116,808	(23,362)	[5,607]	{2,803}	117,302	(23,460)	[5,630]	{2,815}
Washtenaw	25,885	25,920	26,001	26,039	26,109	(5,222)	[1,253]	{627}	26,171	(5,234)	[1,256]	{628}	26,231	(5,246)	[1,259]	{630}
Wayne	159,745	160,161	160,583	160,985	161,648	(32,330)	[7,759]	{3,880}	162,244	(32,449)	[7,788]	{3,894}	162,806	(32,561)	[7,815]	{3,907}

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.