

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

Date: 5/24/21

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 5/24/21 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.

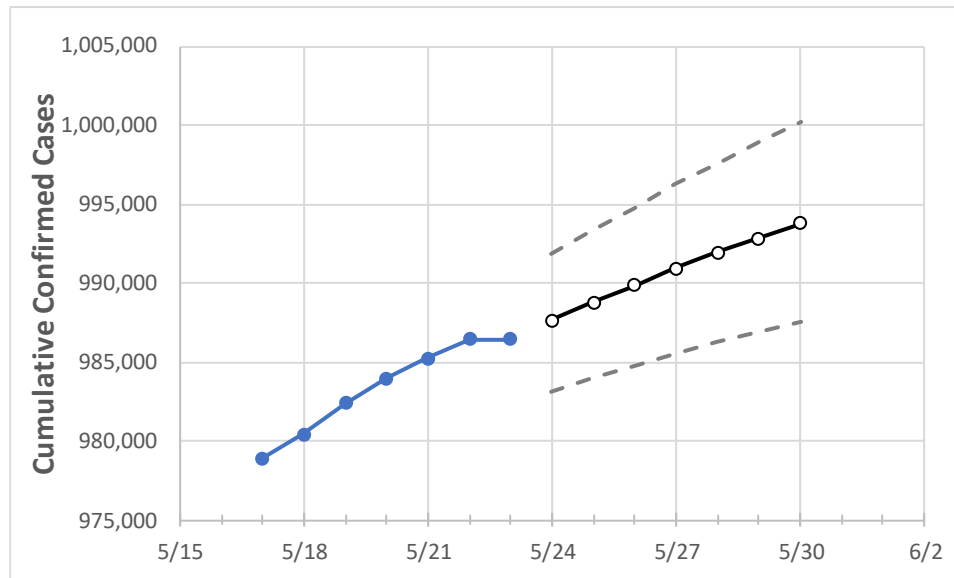
IEM's Modeling Lead

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:						
	5/20	5/21	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30
Michigan	983,970	985,229	986,435	986,435	987,643	988,765	989,874	990,923	991,923	992,836	993,753

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:						
	5/20	5/21	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30
Genesee	41,346	41,386	41,415	41,415	41,450	41,483	41,512	41,540	41,565	41,590	41,615
Ingham	24,577	24,605	24,625	24,625	24,652	24,679	24,705	24,729	24,752	24,775	24,797
Kent	71,861	71,965	72,181	72,181	72,299	72,408	72,517	72,619	72,722	72,819	72,914
Livingston	16,516	16,536	16,552	16,552	16,568	16,583	16,597	16,611	16,625	16,637	16,648
Macomb	98,887	98,988	99,094	99,094	99,189	99,280	99,368	99,451	99,530	99,602	99,670
Monroe	15,198	15,212	15,228	15,228	15,242	15,255	15,268	15,280	15,291	15,301	15,311
Oakland	116,930	117,046	117,168	117,168	117,308	117,439	117,572	117,697	117,812	117,921	118,020
Washtenaw	26,230	26,252	26,278	26,278	26,299	26,319	26,338	26,356	26,373	26,391	26,406
Wayne	162,760	163,016	163,220	163,220	163,407	163,584	163,747	163,905	164,054	164,197	164,335

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:											
	5/20	5/21	5/22	5/23	5/25				5/27				5/29			
Genesee	41,346	41,386	41,415	41,415	41,483	(8,297)	[1,991]	{996}	41,540	(8,308)	[1,994]	{997}	41,590	(8,318)	[1,996]	{998}
Ingham	24,577	24,605	24,625	24,625	24,679	(4,936)	[1,185]	{592}	24,729	(4,946)	[1,187]	{593}	24,775	(4,955)	[1,189]	{595}
Kent	71,861	71,965	72,181	72,181	72,408	(14,482)	[3,476]	{1,738}	72,619	(14,524)	[3,486]	{1,743}	72,819	(14,564)	[3,495]	{1,748}
Livingston	16,516	16,536	16,552	16,552	16,583	(3,317)	[796]	{398}	16,611	(3,322)	[797]	{399}	16,637	(3,327)	[799]	{399}
Macomb	98,887	98,988	99,094	99,094	99,280	(19,856)	[4,765]	{2,383}	99,451	(19,890)	[4,774]	{2,387}	99,602	(19,920)	[4,781]	{2,390}
Monroe	15,198	15,212	15,228	15,228	15,255	(3,051)	[732]	{366}	15,280	(3,056)	[733]	{367}	15,301	(3,060)	[734]	{367}
Oakland	116,930	117,046	117,168	117,168	117,439	(23,488)	[5,637]	{2,819}	117,697	(23,539)	[5,649]	{2,825}	117,921	(23,584)	[5,660]	{2,830}
Washtenaw	26,230	26,252	26,278	26,278	26,319	(5,264)	[1,263]	{632}	26,356	(5,271)	[1,265]	{633}	26,391	(5,278)	[1,267]	{633}
Wayne	162,760	163,016	163,220	163,220	163,584	(32,717)	[7,852]	{3,926}	163,905	(32,781)	[7,867]	{3,934}	164,197	(32,839)	[7,881]	{3,941}

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.