

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 3/11/22**

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 3/11/22 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.

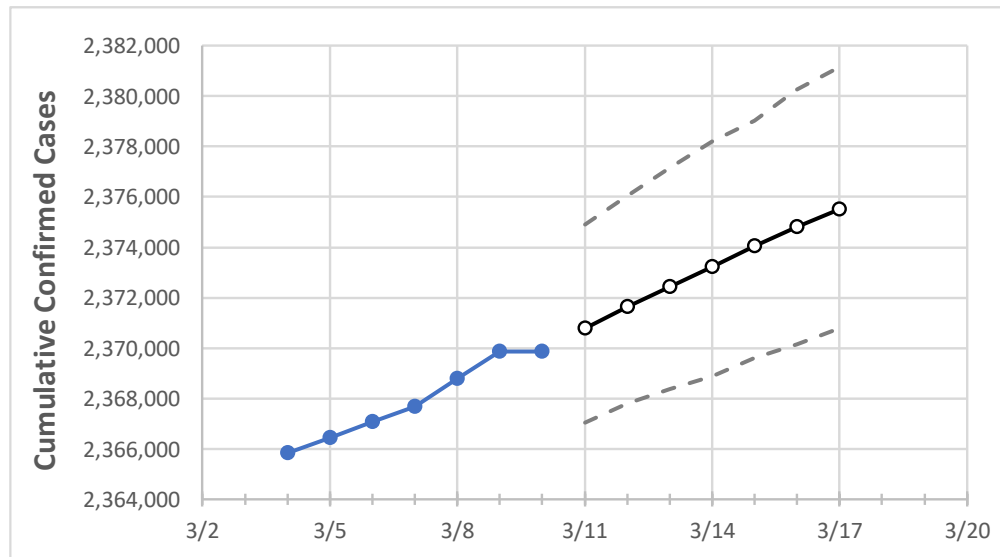
IEM's Modeling Lead

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:						
	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16	3/17	
Michigan	2,367,688	2,368,771	2,369,853	2,369,853	2,370,772	2,371,640	2,372,436	2,373,236	2,374,061	2,374,805	2,375,505	

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:							
	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16	3/17	
Genesee	100,332	100,375	100,417	100,417	100,446	100,472	100,499	100,523	100,548	100,573	100,595	
Ingham	63,288	63,314	63,339	63,339	63,366	63,390	63,413	63,436	63,460	63,480	63,501	
Kent	165,289	165,344	165,398	165,398	165,456	165,516	165,569	165,629	165,688	165,747	165,798	
Livingston	45,416	45,444	45,471	45,471	45,486	45,501	45,516	45,530	45,544	45,557	45,570	
Macomb	225,635	225,821	226,006	226,006	226,131	226,259	226,385	226,500	226,628	226,753	226,868	
Monroe	37,637	37,647	37,656	37,656	37,665	37,674	37,681	37,689	37,697	37,704	37,711	
Oakland	282,960	283,092	283,223	283,223	283,320	283,422	283,500	283,591	283,673	283,763	283,841	
Washtenaw	73,294	73,357	73,420	73,420	73,477	73,531	73,582	73,628	73,672	73,725	73,767	
Wayne	393,795	393,951	394,107	394,107	394,247	394,390	394,508	394,637	394,762	394,886	395,002	

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:											
	3/7	3/8	3/9	3/10	3/12				3/14				3/16			
Genesee	100,332	100,375	100,417	100,417	100,472	(20,094)	[4,823]	{2,411}	100,523	(20,105)	[4,825]	{2,413}	100,573	(20,115)	[4,827]	{2,414}
Ingham	63,288	63,314	63,339	63,339	63,390	(12,678)	[3,043]	{1,521}	63,436	(12,687)	[3,045]	{1,522}	63,480	(12,696)	[3,047]	{1,524}
Kent	165,289	165,344	165,398	165,398	165,516	(33,103)	[7,945]	{3,972}	165,629	(33,126)	[7,950]	{3,975}	165,747	(33,149)	[7,956]	{3,978}
Livingston	45,416	45,444	45,471	45,471	45,501	(9,100)	[2,184]	{1,092}	45,530	(9,106)	[2,185]	{1,093}	45,557	(9,111)	[2,187]	{1,093}
Macomb	225,635	225,821	226,006	226,006	226,259	(45,252)	[10,860]	{5,430}	226,500	(45,300)	[10,872]	{5,436}	226,753	(45,351)	[10,884]	{5,442}
Monroe	37,637	37,647	37,656	37,656	37,674	(7,535)	[1,808]	{904}	37,689	(7,538)	[1,809]	{905}	37,704	(7,541)	[1,810]	{905}
Oakland	282,960	283,092	283,223	283,223	283,422	(56,684)	[13,604]	{6,802}	283,591	(56,718)	[13,612]	{6,806}	283,763	(56,753)	[13,621]	{6,810}
Washtenaw	73,294	73,357	73,420	73,420	73,531	(14,706)	[3,529]	{1,765}	73,628	(14,726)	[3,534]	{1,767}	73,725	(14,745)	[3,539]	{1,769}
Wayne	393,795	393,951	394,107	394,107	394,390	(78,878)	[18,931]	{9,465}	394,637	(78,927)	[18,943]	{9,471}	394,886	(78,977)	[18,955]	{9,477}

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.