

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

Date: 3/8/22

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 3/8/22 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.

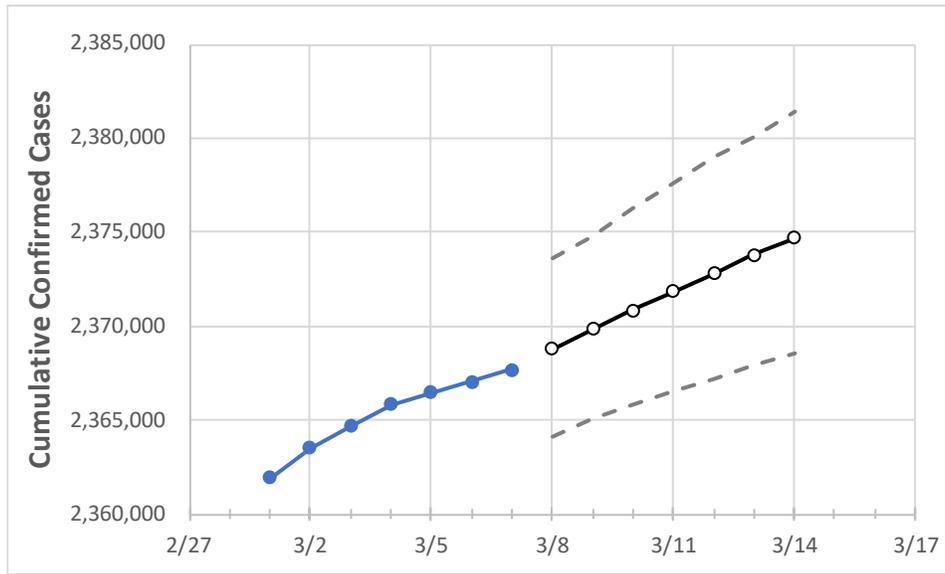
IEM's Modeling Lead

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:							
	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	
Michigan	2,365,827	2,366,447	2,367,068	2,367,688	2,368,811	2,369,859	2,370,864	2,371,868	2,372,799	2,373,808	2,374,711	

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:							
	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	
Genesee	100,291	100,305	100,318	100,332	100,364	100,394	100,421	100,447	100,473	100,501	100,523	
Ingham	63,236	63,253	63,271	63,288	63,322	63,352	63,381	63,408	63,435	63,462	63,487	
Kent	165,176	165,214	165,251	165,289	165,361	165,435	165,507	165,582	165,649	165,715	165,782	
Livingston	45,376	45,389	45,403	45,416	45,434	45,451	45,466	45,481	45,495	45,512	45,526	
Macomb	225,432	225,500	225,567	225,635	225,770	225,899	226,029	226,153	226,283	226,409	226,525	
Monroe	37,608	37,618	37,627	37,637	37,647	37,657	37,666	37,675	37,683	37,691	37,699	
Oakland	282,733	282,809	282,884	282,960	283,062	283,163	283,260	283,358	283,444	283,539	283,617	
Washtenaw	73,203	73,233	73,264	73,294	73,362	73,424	73,486	73,539	73,597	73,658	73,711	
Wayne	393,515	393,608	393,702	393,795	393,944	394,115	394,269	394,407	394,581	394,730	394,844	

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:											
	3/4	3/5	3/6	3/7	3/9			3/11			3/13					
Genesee	100,291	100,305	100,318	100,332	100,394	(20,079)	[4,819]	{2,409}	100,447	(20,089)	[4,821]	{2,411}	100,501	(20,100)	[4,824]	{2,412}
Ingham	63,236	63,253	63,271	63,288	63,352	(12,670)	[3,041]	{1,520}	63,408	(12,682)	[3,044]	{1,522}	63,462	(12,692)	[3,046]	{1,523}
Kent	165,176	165,214	165,251	165,289	165,435	(33,087)	[7,941]	{3,970}	165,582	(33,116)	[7,948]	{3,974}	165,715	(33,143)	[7,954]	{3,977}
Livingston	45,376	45,389	45,403	45,416	45,451	(9,090)	[2,182]	{1,091}	45,481	(9,096)	[2,183]	{1,092}	45,512	(9,102)	[2,185]	{1,092}
Macomb	225,432	225,500	225,567	225,635	225,899	(45,180)	[10,843]	{5,422}	226,153	(45,231)	[10,855]	{5,428}	226,409	(45,282)	[10,868]	{5,434}
Monroe	37,608	37,618	37,627	37,637	37,657	(7,531)	[1,808]	{904}	37,675	(7,535)	[1,808]	{904}	37,691	(7,538)	[1,809]	{905}
Oakland	282,733	282,809	282,884	282,960	283,163	(56,633)	[13,592]	{6,796}	283,358	(56,672)	[13,601]	{6,801}	283,539	(56,708)	[13,610]	{6,805}
Washtenaw	73,203	73,233	73,264	73,294	73,424	(14,685)	[3,524]	{1,762}	73,539	(14,708)	[3,530]	{1,765}	73,658	(14,732)	[3,536]	{1,768}
Wayne	393,515	393,608	393,702	393,795	394,115	(78,823)	[18,918]	{9,459}	394,407	(78,881)	[18,932]	{9,466}	394,730	(78,946)	[18,947]	{9,474}

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.