

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

Date: 4/27/21

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 4/27/21 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.

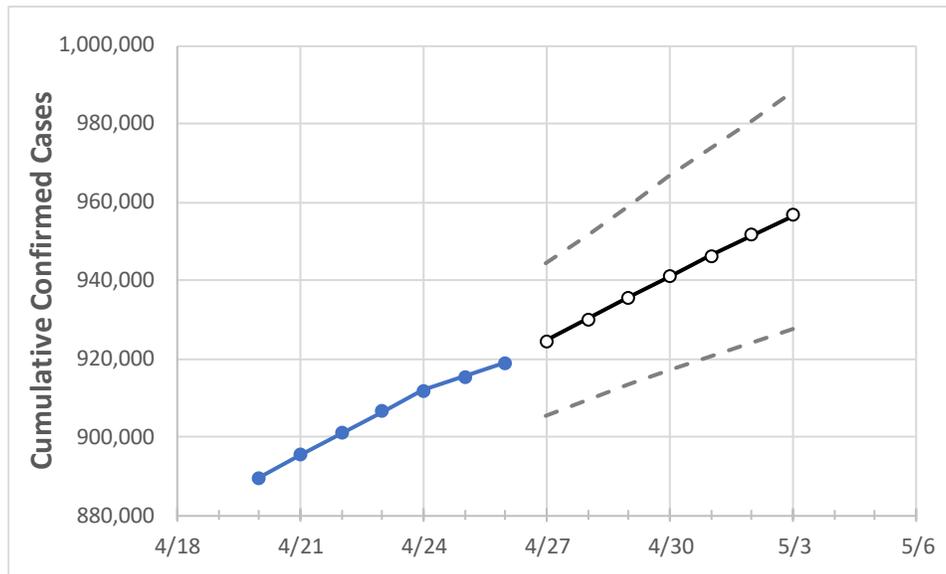
IEM's Modeling Lead

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:							
	4/23	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3	
Michigan	906,596	911,800	915,340	918,880	924,486	930,107	935,560	940,972	946,288	951,478	956,513	

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:							
	4/23	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3	
Genesee	38,209	38,385	38,553	38,720	38,976	39,231	39,475	39,717	39,947	40,176	40,396	
Ingham	23,057	23,164	23,258	23,351	23,460	23,563	23,666	23,766	23,861	23,960	24,049	
Kent	65,948	66,323	66,603	66,882	67,302	67,720	68,150	68,569	68,999	69,421	69,850	
Livingston	15,249	15,321	15,396	15,471	15,574	15,676	15,774	15,872	15,970	16,066	16,159	
Macomb	91,649	92,204	92,581	92,958	93,554	94,117	94,672	95,220	95,756	96,274	96,772	
Monroe	14,094	14,175	14,212	14,248	14,325	14,399	14,472	14,544	14,615	14,685	14,753	
Oakland	107,428	108,109	108,484	108,858	109,520	110,158	110,805	111,428	112,039	112,636	113,253	
Washtenaw	24,808	24,931	24,994	25,057	25,181	25,304	25,426	25,544	25,658	25,772	25,886	
Wayne	149,218	150,249	150,976	151,702	152,785	153,830	154,848	155,858	156,872	157,853	158,857	

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:											
	4/23	4/24	4/25	4/26	4/28				4/30				5/2			
Genesee	38,209	38,385	38,553	38,720	39,231	(7,846)	[1,883]	{942}	39,717	(7,943)	[1,906]	{953}	40,176	(8,035)	[1,928]	{964}
Ingham	23,057	23,164	23,258	23,351	23,563	(4,713)	[1,131]	{566}	23,766	(4,753)	[1,141]	{570}	23,960	(4,792)	[1,150]	{575}
Kent	65,948	66,323	66,603	66,882	67,720	(13,544)	[3,251]	{1,625}	68,569	(13,714)	[3,291]	{1,646}	69,421	(13,884)	[3,332]	{1,666}
Livingston	15,249	15,321	15,396	15,471	15,676	(3,135)	[752]	{376}	15,872	(3,174)	[762]	{381}	16,066	(3,213)	[771]	{386}
Macomb	91,649	92,204	92,581	92,958	94,117	(18,823)	[4,518]	{2,259}	95,220	(19,044)	[4,571]	{2,285}	96,274	(19,255)	[4,621]	{2,311}
Monroe	14,094	14,175	14,212	14,248	14,399	(2,880)	[691]	{346}	14,544	(2,909)	[698]	{349}	14,685	(2,937)	[705]	{352}
Oakland	107,428	108,109	108,484	108,858	110,158	(22,032)	[5,288]	{2,644}	111,428	(22,286)	[5,349]	{2,674}	112,636	(22,527)	[5,407]	{2,703}
Washtenaw	24,808	24,931	24,994	25,057	25,304	(5,061)	[1,215]	{607}	25,544	(5,109)	[1,226]	{613}	25,772	(5,154)	[1,237]	{619}
Wayne	149,218	150,249	150,976	151,702	153,830	(30,766)	[7,384]	{3,692}	155,858	(31,172)	[7,481]	{3,741}	157,853	(31,571)	[7,577]	{3,788}

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.