

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 4/22/21**

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 4/22/21 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.

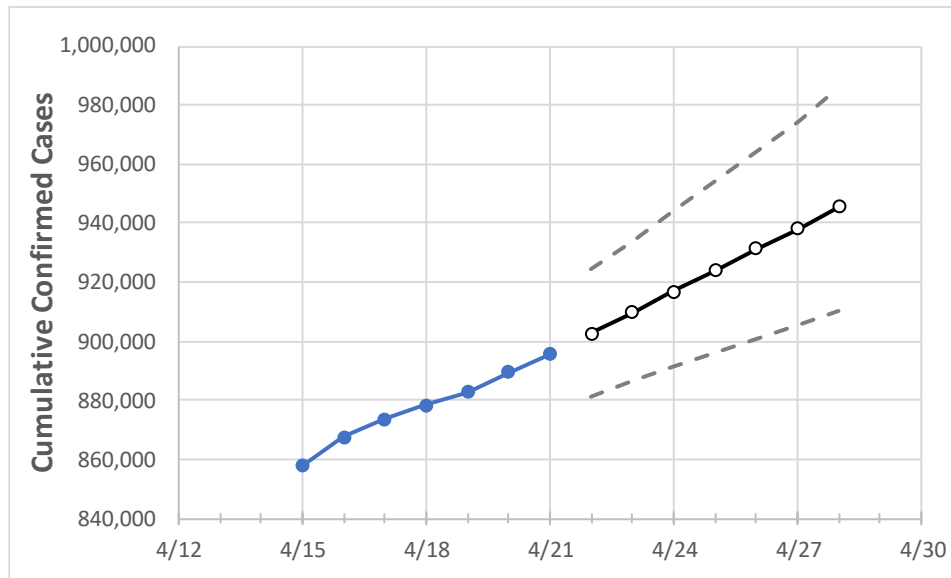
IEM's Modeling Lead

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:						
	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	4/28
Michigan	878,286	882,871	889,472	895,445	902,573	909,684	916,904	924,091	931,255	938,259	945,552

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:							
	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	4/28	
Genesee	36,728	36,957	37,296	37,620	37,966	38,307	38,643	38,977	39,316	39,650	39,983	
Ingham	22,509	22,610	22,690	22,836	22,970	23,100	23,230	23,353	23,478	23,603	23,725	
Kent	64,094	64,478	64,844	65,246	65,748	66,253	66,771	67,287	67,837	68,352	68,897	
Livingston	14,756	14,858	14,930	15,052	15,187	15,318	15,451	15,585	15,723	15,859	15,992	
Macomb	88,369	88,958	89,887	90,496	91,240	91,974	92,705	93,427	94,142	94,851	95,535	
Monroe	13,691	13,761	13,896	13,975	14,082	14,191	14,298	14,407	14,515	14,628	14,734	
Oakland	104,184	104,644	105,398	106,108	106,930	107,756	108,564	109,380	110,180	110,990	111,803	
Washtenaw	24,250	24,362	24,459	24,591	24,767	24,940	25,115	25,291	25,464	25,639	25,808	
Wayne	144,070	144,922	146,247	147,233	148,581	149,902	151,239	152,596	153,894	155,223	156,582	

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:											
	4/18	4/19	4/20	4/21	4/23				4/25				4/27			
Genesee	36,728	36,957	37,296	37,620	38,307	(7,661)	[1,839]	{919}	38,977	(7,795)	[1,871]	{935}	39,650	(7,930)	[1,903]	{952}
Ingham	22,509	22,610	22,690	22,836	23,100	(4,620)	[1,109]	{554}	23,353	(4,671)	[1,121]	{560}	23,603	(4,721)	[1,133]	{566}
Kent	64,094	64,478	64,844	65,246	66,253	(13,251)	[3,180]	{1,590}	67,287	(13,457)	[3,230]	{1,615}	68,352	(13,670)	[3,281]	{1,640}
Livingston	14,756	14,858	14,930	15,052	15,318	(3,064)	[735]	{368}	15,585	(3,117)	[748]	{374}	15,859	(3,172)	[761]	{381}
Macomb	88,369	88,958	89,887	90,496	91,974	(18,395)	[4,415]	{2,207}	93,427	(18,685)	[4,485]	{2,242}	94,851	(18,970)	[4,553]	{2,276}
Monroe	13,691	13,761	13,896	13,975	14,191	(2,838)	[681]	{341}	14,407	(2,881)	[692]	{346}	14,628	(2,926)	[702]	{351}
Oakland	104,184	104,644	105,398	106,108	107,756	(21,551)	[5,172]	{2,586}	109,380	(21,876)	[5,250]	{2,625}	110,990	(22,198)	[5,328]	{2,664}
Washtenaw	24,250	24,362	24,459	24,591	24,940	(4,988)	[1,197]	{599}	25,291	(5,058)	[1,214]	{607}	25,639	(5,128)	[1,231]	{615}
Wayne	144,070	144,922	146,247	147,233	149,902	(29,980)	[7,195]	{3,598}	152,596	(30,519)	[7,325]	{3,662}	155,223	(31,045)	[7,451]	{3,725}

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.