

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

Date: 4/23/21

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 4/23/21 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.

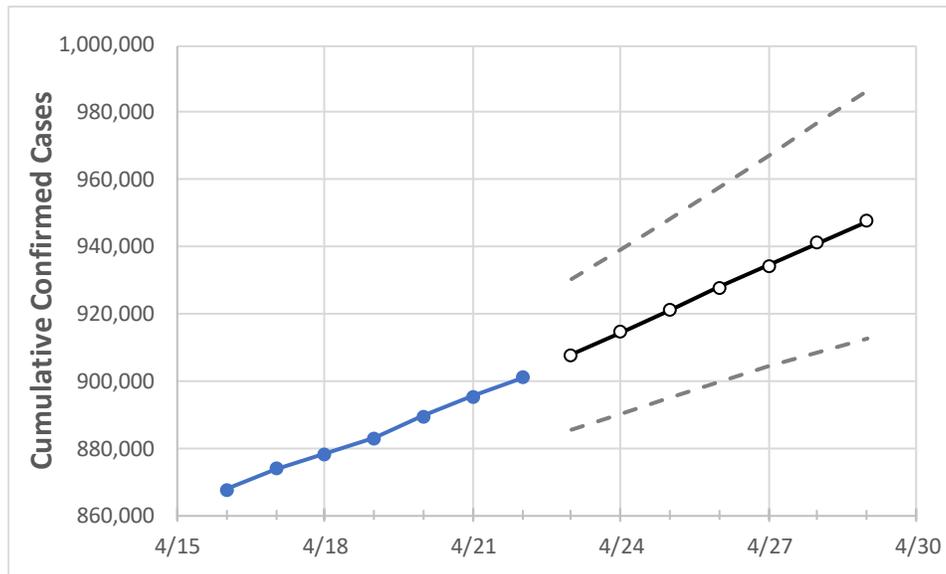
IEM's Modeling Lead

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:							
	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	4/28	4/29	
Michigan	882,871	889,472	895,445	900,956	907,749	914,520	921,186	927,878	934,404	940,996	947,600	

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:							
	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	4/28	4/29	
Genesee	36,957	37,296	37,620	37,926	38,277	38,629	38,975	39,317	39,661	40,007	40,341	
Ingham	22,610	22,690	22,836	22,955	23,084	23,208	23,329	23,451	23,567	23,683	23,797	
Kent	64,478	64,844	65,246	65,600	66,090	66,589	67,084	67,595	68,108	68,646	69,168	
Livingston	14,858	14,930	15,052	15,153	15,279	15,406	15,531	15,654	15,776	15,898	16,018	
Macomb	88,958	89,887	90,496	91,150	91,865	92,564	93,253	93,953	94,619	95,294	95,947	
Monroe	13,761	13,896	13,975	14,025	14,126	14,227	14,327	14,426	14,527	14,625	14,724	
Oakland	104,644	105,398	106,108	106,756	107,538	108,309	109,064	109,823	110,571	111,323	112,056	
Washtenaw	24,362	24,459	24,591	24,718	24,886	25,052	25,220	25,388	25,553	25,723	25,890	
Wayne	144,922	146,247	147,233	148,223	149,495	150,735	151,986	153,219	154,396	155,592	156,810	

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:											
	4/19	4/20	4/21	4/22	4/24				4/26				4/28			
Genesee	36,957	37,296	37,620	37,926	38,629	(7,726)	[1,854]	{927}	39,317	(7,863)	[1,887]	{944}	40,007	(8,001)	[1,920]	{960}
Ingham	22,610	22,690	22,836	22,955	23,208	(4,642)	[1,114]	{557}	23,451	(4,690)	[1,126]	{563}	23,683	(4,737)	[1,137]	{568}
Kent	64,478	64,844	65,246	65,600	66,589	(13,318)	[3,196]	{1,598}	67,595	(13,519)	[3,245]	{1,622}	68,646	(13,729)	[3,295]	{1,648}
Livingston	14,858	14,930	15,052	15,153	15,406	(3,081)	[739]	{370}	15,654	(3,131)	[751]	{376}	15,898	(3,180)	[763]	{382}
Macomb	88,958	89,887	90,496	91,150	92,564	(18,513)	[4,443]	{2,222}	93,953	(18,791)	[4,510]	{2,255}	95,294	(19,059)	[4,574]	{2,287}
Monroe	13,761	13,896	13,975	14,025	14,227	(2,845)	[683]	{341}	14,426	(2,885)	[692]	{346}	14,625	(2,925)	[702]	{351}
Oakland	104,644	105,398	106,108	106,756	108,309	(21,662)	[5,199]	{2,599}	109,823	(21,965)	[5,272]	{2,636}	111,323	(22,265)	[5,343]	{2,672}
Washtenaw	24,362	24,459	24,591	24,718	25,052	(5,010)	[1,203]	{601}	25,388	(5,078)	[1,219]	{609}	25,723	(5,145)	[1,235]	{617}
Wayne	144,922	146,247	147,233	148,223	150,735	(30,147)	[7,235]	{3,618}	153,219	(30,644)	[7,355]	{3,677}	155,592	(31,118)	[7,468]	{3,734}

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.