

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

Date: 4/6/21

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 4/6/21 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.

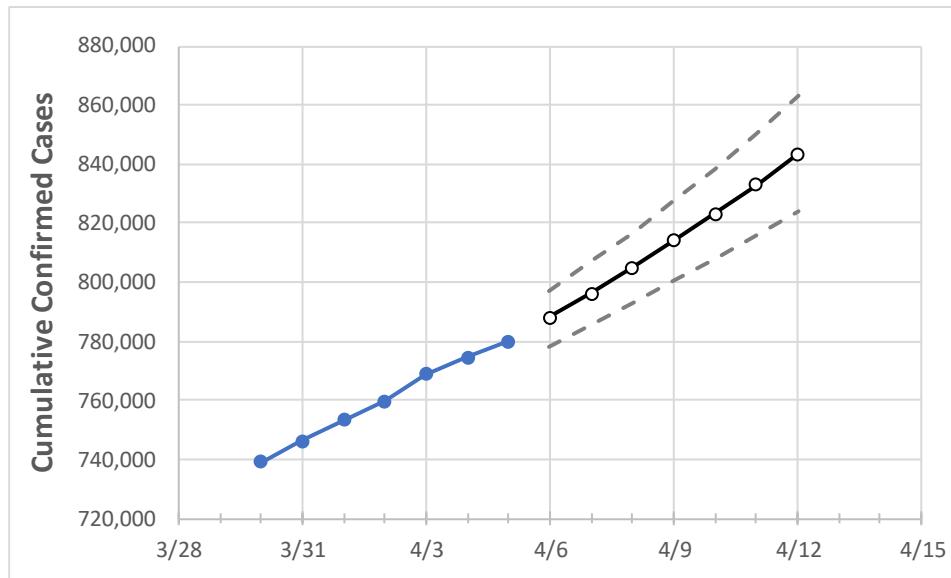
IEM's Modeling Lead

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:							
	4/2	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	
Michigan	759,600	768,892	774,433	779,974	787,997	796,341	804,954	813,921	823,357	833,150	843,381	

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:							
	4/2	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	
Genesee	31,028	31,410	31,649	31,888	32,253	32,634	33,035	33,452	33,888	34,331	34,808	
Ingham	19,878	20,036	20,194	20,352	20,573	20,802	21,041	21,282	21,538	21,800	22,074	
Kent	57,265	57,741	58,019	58,297	58,718	59,158	59,619	60,103	60,626	61,180	61,747	
Livingston	12,507	12,631	12,747	12,863	12,993	13,128	13,266	13,407	13,553	13,700	13,853	
Macomb	74,405	75,793	76,537	77,281	78,396	79,551	80,748	82,001	83,296	84,642	86,034	
Monroe	11,879	12,013	12,097	12,180	12,311	12,442	12,581	12,727	12,881	13,037	13,203	
Oakland	89,337	90,618	91,436	92,253	93,284	94,372	95,503	96,677	97,903	99,163	100,487	
Washtenaw	21,259	21,439	21,548	21,657	21,837	22,024	22,218	22,421	22,632	22,854	23,084	
Wayne	121,125	122,971	124,168	125,364	126,896	128,523	130,231	132,031	133,908	135,878	137,960	

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:											
	4/2	4/3	4/4	4/5	4/7				4/9				4/11			
Genesee	31,028	31,410	31,649	31,888	32,634	(6,527)	[1,566]	{783}	33,452	(6,690)	[1,606]	{803}	34,331	(6,866)	[1,648]	{824}
Ingham	19,878	20,036	20,194	20,352	20,802	(4,160)	[998]	{499}	21,282	(4,256)	[1,022]	{511}	21,800	(4,360)	[1,046]	{523}
Kent	57,265	57,741	58,019	58,297	59,158	(11,832)	[2,840]	{1,420}	60,103	(12,021)	[2,885]	{1,442}	61,180	(12,236)	[2,937]	{1,468}
Livingston	12,507	12,631	12,747	12,863	13,128	(2,626)	[630]	{315}	13,407	(2,681)	[644]	{322}	13,700	(2,740)	[658]	{329}
Macomb	74,405	75,793	76,537	77,281	79,551	(15,910)	[3,818]	{1,909}	82,001	(16,400)	[3,936]	{1,968}	84,642	(16,928)	[4,063]	{2,031}
Monroe	11,879	12,013	12,097	12,180	12,442	(2,488)	[597]	{299}	12,727	(2,545)	[611]	{305}	13,037	(2,607)	[626]	{313}
Oakland	89,337	90,618	91,436	92,253	94,372	(18,874)	[4,530]	{2,265}	96,677	(19,335)	[4,641]	{2,320}	99,163	(19,833)	[4,760]	{2,380}
Washtenaw	21,259	21,439	21,548	21,657	22,024	(4,405)	[1,057]	{529}	22,421	(4,484)	[1,076]	{538}	22,854	(4,571)	[1,097]	{548}
Wayne	121,125	122,971	124,168	125,364	128,523	(25,705)	[6,169]	{3,085}	132,031	(26,406)	[6,337]	{3,169}	135,878	(27,176)	[6,522]	{3,261}

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.