

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

Date: 4/14/21

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 4/14/21 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.

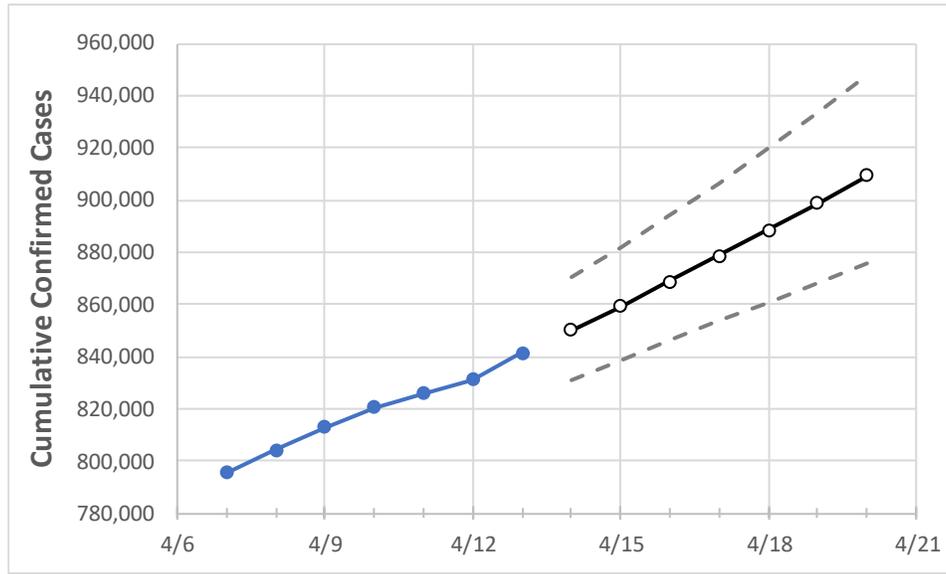
IEM's Modeling Lead

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:							
	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	
Michigan	820,404	825,681	830,957	841,234	850,100	859,338	868,779	878,443	888,476	898,905	909,511	

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:							
	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	
Genesee	33,864	34,144	34,423	34,852	35,273	35,709	36,149	36,605	37,070	37,553	38,050	
Ingham	21,227	21,383	21,538	21,733	21,925	22,118	22,315	22,513	22,716	22,917	23,121	
Kent	60,392	60,634	60,875	61,478	61,961	62,463	62,985	63,529	64,098	64,683	65,300	
Livingston	13,646	13,769	13,891	14,102	14,276	14,452	14,636	14,827	15,022	15,226	15,438	
Macomb	81,863	82,472	83,081	84,328	85,392	86,473	87,578	88,687	89,814	90,971	92,128	
Monroe	12,777	12,867	12,957	13,209	13,372	13,537	13,713	13,898	14,084	14,285	14,488	
Oakland	97,070	97,684	98,298	99,595	100,655	101,732	102,842	103,989	105,159	106,340	107,571	
Washtenaw	22,746	22,868	22,989	23,360	23,598	23,842	24,101	24,371	24,660	24,956	25,259	
Wayne	133,169	134,208	135,247	137,370	139,226	141,114	143,096	145,163	147,264	149,429	151,666	

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:											
	4/10	4/11	4/12	4/13	4/15				4/17				4/19			
Genesee	33,864	34,144	34,423	34,852	35,709	(7,142)	[1,714]	{857}	36,605	(7,321)	[1,757]	{879}	37,553	(7,511)	[1,803]	{901}
Ingham	21,227	21,383	21,538	21,733	22,118	(4,424)	[1,062]	{531}	22,513	(4,503)	[1,081]	{540}	22,917	(4,583)	[1,100]	{550}
Kent	60,392	60,634	60,875	61,478	62,463	(12,493)	[2,998]	{1,499}	63,529	(12,706)	[3,049]	{1,525}	64,683	(12,937)	[3,105]	{1,552}
Livingston	13,646	13,769	13,891	14,102	14,452	(2,890)	[694]	{347}	14,827	(2,965)	[712]	{356}	15,226	(3,045)	[731]	{365}
Macomb	81,863	82,472	83,081	84,328	86,473	(17,295)	[4,151]	{2,075}	88,687	(17,737)	[4,257]	{2,128}	90,971	(18,194)	[4,367]	{2,183}
Monroe	12,777	12,867	12,957	13,209	13,537	(2,707)	[650]	{325}	13,898	(2,780)	[667]	{334}	14,285	(2,857)	[686]	{343}
Oakland	97,070	97,684	98,298	99,595	101,732	(20,346)	[4,883]	{2,442}	103,989	(20,798)	[4,991]	{2,496}	106,340	(21,268)	[5,104]	{2,552}
Washtenaw	22,746	22,868	22,989	23,360	23,842	(4,768)	[1,144]	{572}	24,371	(4,874)	[1,170]	{585}	24,956	(4,991)	[1,198]	{599}
Wayne	133,169	134,208	135,247	137,370	141,114	(28,223)	[6,773]	{3,387}	145,163	(29,033)	[6,968]	{3,484}	149,429	(29,886)	[7,173]	{3,586}

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.