

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

Date: 1/7/21

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 1/7/21 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.

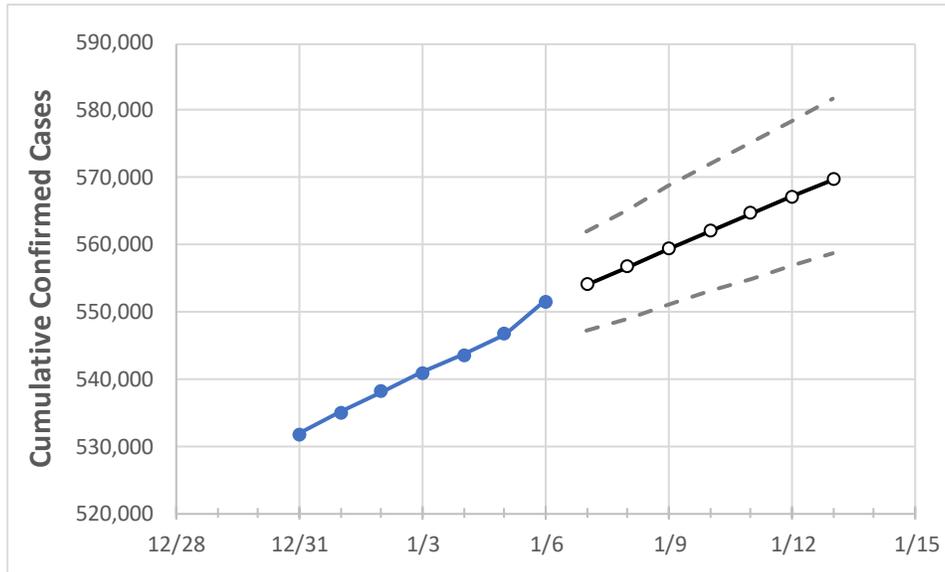
IEM's Modeling Lead

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:							
	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	
Michigan	540,866	543,611	546,642	551,498	554,140	556,796	559,457	562,089	564,706	567,279	569,783	

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:							
	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	
Genesee	21,912	22,003	22,100	22,270	22,340	22,406	22,469	22,529	22,586	22,642	22,694	
Ingham	12,956	13,032	13,109	13,212	13,291	13,368	13,444	13,521	13,598	13,674	13,749	
Kent	44,217	44,380	44,675	45,025	45,239	45,449	45,655	45,865	46,072	46,285	46,489	
Livingston	8,070	8,142	8,214	8,328	8,386	8,445	8,504	8,565	8,626	8,687	8,750	
Macomb	50,356	50,588	50,755	51,199	51,381	51,553	51,725	51,894	52,057	52,220	52,382	
Monroe	7,860	7,912	7,992	8,099	8,153	8,207	8,262	8,318	8,373	8,429	8,485	
Oakland	62,460	62,826	63,188	63,751	64,056	64,361	64,657	64,962	65,266	65,565	65,860	
Washtenaw	14,054	14,148	14,263	14,411	14,505	14,599	14,694	14,787	14,882	14,979	15,077	
Wayne	86,437	86,878	87,259	88,029	88,366	88,716	89,052	89,379	89,705	90,018	90,324	

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:											
	1/3	1/4	1/5	1/6	1/8			1/10			1/12					
Genesee	21,912	22,003	22,100	22,270	22,406	(4,481)	[1,075]	{538}	22,529	(4,506)	[1,081]	{541}	22,642	(4,528)	[1,087]	{543}
Ingham	12,956	13,032	13,109	13,212	13,368	(2,674)	[642]	{321}	13,521	(2,704)	[649]	{325}	13,674	(2,735)	[656]	{328}
Kent	44,217	44,380	44,675	45,025	45,449	(9,090)	[2,182]	{1,091}	45,865	(9,173)	[2,202]	{1,101}	46,285	(9,257)	[2,222]	{1,111}
Livingston	8,070	8,142	8,214	8,328	8,445	(1,689)	[405]	{203}	8,565	(1,713)	[411]	{206}	8,687	(1,737)	[417]	{208}
Macomb	50,356	50,588	50,755	51,199	51,553	(10,311)	[2,475]	{1,237}	51,894	(10,379)	[2,491]	{1,245}	52,220	(10,444)	[2,507]	{1,253}
Monroe	7,860	7,912	7,992	8,099	8,207	(1,641)	[394]	{197}	8,318	(1,664)	[399]	{200}	8,429	(1,686)	[405]	{202}
Oakland	62,460	62,826	63,188	63,751	64,361	(12,872)	[3,089]	{1,545}	64,962	(12,992)	[3,118]	{1,559}	65,565	(13,113)	[3,147]	{1,574}
Washtenaw	14,054	14,148	14,263	14,411	14,599	(2,920)	[701]	{350}	14,787	(2,957)	[710]	{355}	14,979	(2,996)	[719]	{360}
Wayne	86,437	86,878	87,259	88,029	88,716	(17,743)	[4,258]	{2,129}	89,379	(17,876)	[4,290]	{2,145}	90,018	(18,004)	[4,321]	{2,160}

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.