

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

Date: 3/22/22

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 3/22/22 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.

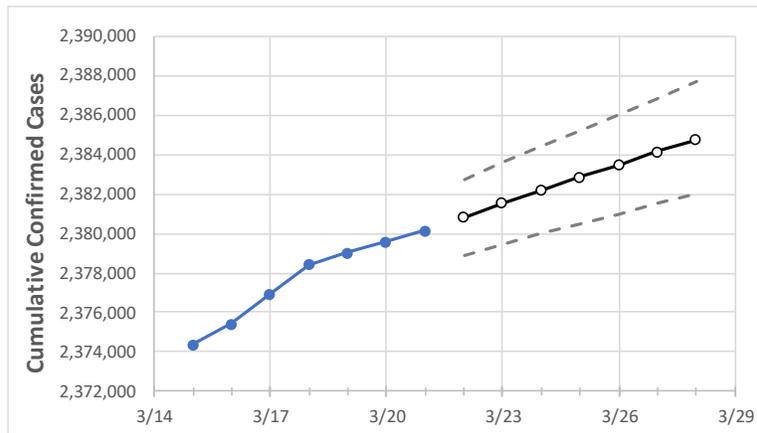
IEM's Modeling Lead

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:							
	3/18	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	
Michigan	2,378,439	2,379,011	2,379,583	2,380,155	2,380,838	2,381,533	2,382,205	2,382,874	2,383,487	2,384,147	2,384,768	

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:							
	3/18	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	
Genesee	100,680	100,696	100,711	100,727	100,749	100,771	100,791	100,810	100,831	100,849	100,866	
Ingham	63,555	63,576	63,597	63,618	63,638	63,657	63,676	63,694	63,713	63,731	63,749	
Kent	165,760	165,783	165,806	165,829	165,859	165,888	165,916	165,944	165,971	165,997	166,023	
Livingston	45,673	45,690	45,706	45,723	45,741	45,759	45,777	45,795	45,813	45,831	45,849	
Macomb	227,232	227,314	227,396	227,478	227,589	227,702	227,810	227,919	228,029	228,130	228,241	
Monroe	37,768	37,779	37,789	37,800	37,810	37,820	37,830	37,839	37,849	37,859	37,868	
Oakland	284,263	284,341	284,418	284,496	284,590	284,681	284,771	284,860	284,947	285,033	285,119	
Washtenaw	73,802	73,840	73,879	73,917	73,953	73,990	74,024	74,059	74,092	74,126	74,159	
Wayne	396,453	396,569	396,685	396,801	396,980	397,177	397,358	397,548	397,749	397,934	398,130	

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:											
	3/18	3/19	3/20	3/21	3/23			3/25			3/27					
Genesee	100,680	100,696	100,711	100,727	100,771	(20,154)	[4,837]	{2,418}	100,810	(20,162)	[4,839]	{2,419}	100,849	(20,170)	[4,841]	{2,420}
Ingham	63,555	63,576	63,597	63,618	63,657	(12,731)	[3,056]	{1,528}	63,694	(12,739)	[3,057]	{1,529}	63,731	(12,746)	[3,059]	{1,530}
Kent	165,760	165,783	165,806	165,829	165,888	(33,178)	[7,963]	{3,981}	165,944	(33,189)	[7,965]	{3,983}	165,997	(33,199)	[7,968]	{3,984}
Livingston	45,673	45,690	45,706	45,723	45,759	(9,152)	[2,196]	{1,098}	45,795	(9,159)	[2,198]	{1,099}	45,831	(9,166)	[2,200]	{1,100}
Macomb	227,232	227,314	227,396	227,478	227,702	(45,540)	[10,930]	{5,465}	227,919	(45,584)	[10,940]	{5,470}	228,130	(45,626)	[10,950]	{5,475}
Monroe	37,768	37,779	37,789	37,800	37,820	(7,564)	[1,815]	{908}	37,839	(7,568)	[1,816]	{908}	37,859	(7,572)	[1,817]	{909}
Oakland	284,263	284,341	284,418	284,496	284,681	(56,936)	[13,665]	{6,832}	284,860	(56,972)	[13,673]	{6,837}	285,033	(57,007)	[13,682]	{6,841}
Washtenaw	73,802	73,840	73,879	73,917	73,990	(14,798)	[3,552]	{1,776}	74,059	(14,812)	[3,555]	{1,777}	74,126	(14,825)	[3,558]	{1,779}
Wayne	396,453	396,569	396,685	396,801	397,177	(79,435)	[19,064]	{9,532}	397,548	(79,510)	[19,082]	{9,541}	397,934	(79,587)	[19,101]	{9,550}

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.