

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

Date: 6/7/21

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 6/7/21 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.

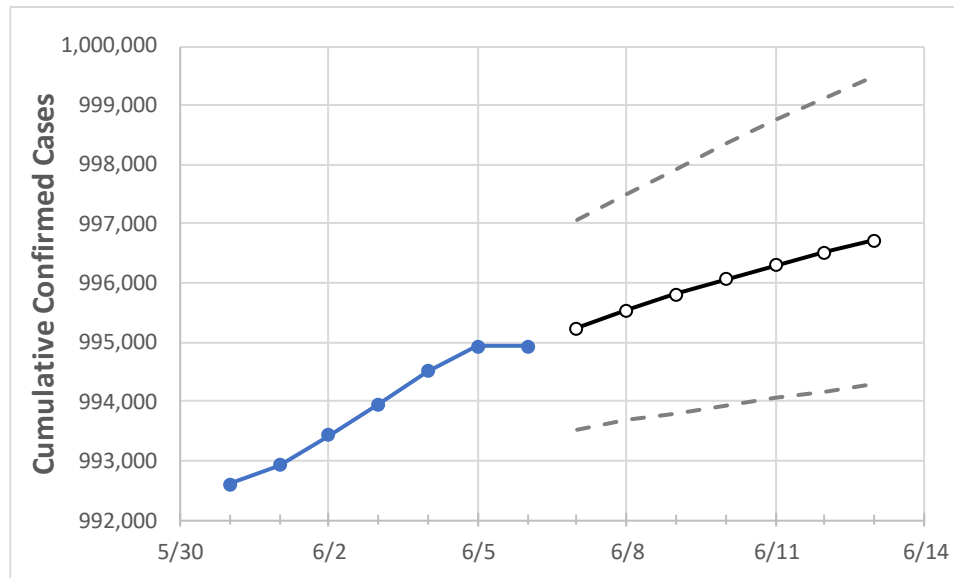
IEM's Modeling Lead

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:						
	6/3	6/4	6/5	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13
Michigan	993,952	994,506	994,935	994,935	995,241	995,533	995,809	996,065	996,302	996,513	996,727

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:						
	6/3	6/4	6/5	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13
Genesee	41,619	41,635	41,643	41,643	41,650	41,656	41,662	41,668	41,672	41,677	41,681
Ingham	24,780	24,789	24,795	24,795	24,802	24,809	24,815	24,821	24,827	24,832	24,837
Kent	72,887	72,925	72,967	72,967	72,991	73,014	73,033	73,051	73,068	73,082	73,097
Livingston	16,653	16,659	16,668	16,668	16,672	16,676	16,680	16,683	16,686	16,689	16,692
Macomb	99,751	99,785	99,816	99,816	99,842	99,865	99,887	99,906	99,924	99,941	99,957
Monroe	15,345	15,356	15,361	15,361	15,366	15,370	15,373	15,377	15,380	15,383	15,385
Oakland	118,035	118,114	118,174	118,174	118,221	118,264	118,306	118,345	118,382	118,416	118,450
Washtenaw	26,400	26,402	26,404	26,404	26,407	26,410	26,412	26,415	26,417	26,419	26,420
Wayne	164,555	164,691	164,769	164,769	164,829	164,888	164,944	164,997	165,043	165,090	165,133

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:											
	6/3	6/4	6/5	6/6	6/8				6/10				6/12			
Genesee	41,619	41,635	41,643	41,643	41,656	(8,331)	[2,000]	{1,000}	41,668	(8,334)	[2,000]	{1,000}	41,677	(8,335)	[2,000]	{1,000}
Ingham	24,780	24,789	24,795	24,795	24,809	(4,962)	[1,191]	{595}	24,821	(4,964)	[1,191]	{596}	24,832	(4,966)	[1,192]	{596}
Kent	72,887	72,925	72,967	72,967	73,014	(14,603)	[3,505]	{1,752}	73,051	(14,610)	[3,506]	{1,753}	73,082	(14,616)	[3,508]	{1,754}
Livingston	16,653	16,659	16,668	16,668	16,676	(3,335)	[800]	{400}	16,683	(3,337)	[801]	{400}	16,689	(3,338)	[801]	{401}
Macomb	99,751	99,785	99,816	99,816	99,865	(19,973)	[4,794]	{2,397}	99,906	(19,981)	[4,795]	{2,398}	99,941	(19,988)	[4,797]	{2,399}
Monroe	15,345	15,356	15,361	15,361	15,370	(3,074)	[738]	{369}	15,377	(3,075)	[738]	{369}	15,383	(3,077)	[738]	{369}
Oakland	118,035	118,114	118,174	118,174	118,264	(23,653)	[5,677]	{2,838}	118,345	(23,669)	[5,681]	{2,840}	118,416	(23,683)	[5,684]	{2,842}
Washtenaw	26,400	26,402	26,404	26,404	26,410	(5,282)	[1,268]	{634}	26,415	(5,283)	[1,268]	{634}	26,419	(5,284)	[1,268]	{634}
Wayne	164,555	164,691	164,769	164,769	164,888	(32,978)	[7,915]	{3,957}	164,997	(32,999)	[7,920]	{3,960}	165,090	(33,018)	[7,924]	{3,962}

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.