

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

Date: 2/23/22

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 2/23/22 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.

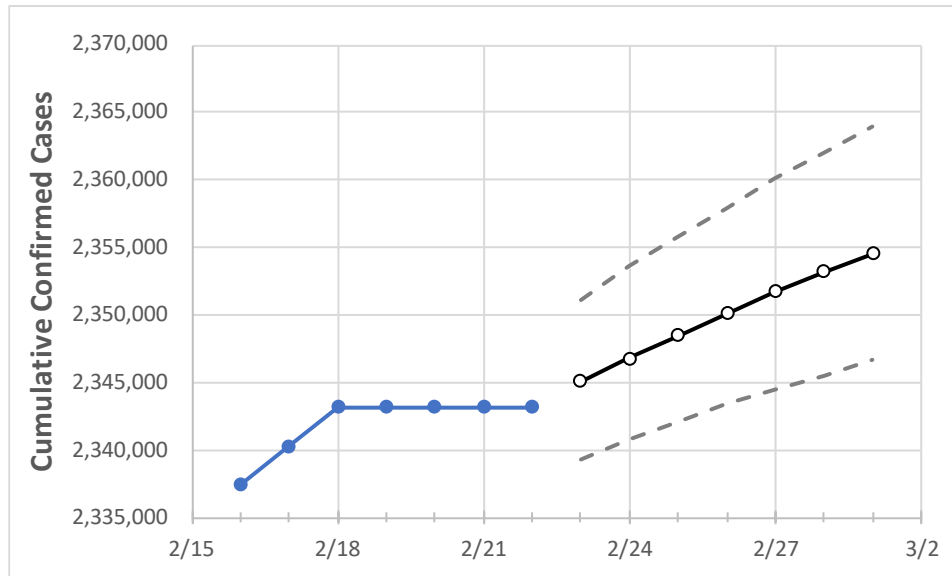
IEM's Modeling Lead

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:							
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	
Michigan	2,343,162	2,343,162	2,343,162	2,343,162	2,345,073	2,346,778	2,348,477	2,350,150	2,351,717	2,353,210	2,354,572	

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:							
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	
Genesee	99,523	99,523	99,523	99,523	99,615	99,711	99,796	99,884	99,956	100,040	100,106	
Ingham	62,535	62,535	62,535	62,535	62,595	62,648	62,700	62,751	62,798	62,843	62,885	
Kent	163,504	163,504	163,504	163,504	163,611	163,709	163,805	163,896	163,982	164,070	164,141	
Livingston	44,996	44,996	44,996	44,996	45,031	45,068	45,099	45,134	45,164	45,196	45,226	
Macomb	222,932	222,932	222,932	222,932	223,046	223,150	223,251	223,352	223,443	223,530	223,615	
Monroe	37,373	37,373	37,373	37,373	37,399	37,425	37,449	37,472	37,493	37,515	37,535	
Oakland	280,254	280,254	280,254	280,254	280,521	280,770	281,015	281,253	281,475	281,703	281,920	
Washtenaw	71,894	71,894	71,894	71,894	72,010	72,121	72,229	72,334	72,444	72,540	72,640	
Wayne	390,140	390,140	390,140	390,140	390,329	390,521	390,687	390,847	391,008	391,151	391,285	

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:											
	2/19	2/20	2/21	2/22	2/24		2/26		2/28							
Genesee	99,523	99,523	99,523	99,523	99,711	(19,942)	[4,786]	{2,393}	99,884	(19,977)	[4,794]	{2,397}	100,040	(20,008)	[4,802]	{2,401}
Ingham	62,535	62,535	62,535	62,535	62,648	(12,530)	[3,007]	{1,504}	62,751	(12,550)	[3,012]	{1,506}	62,843	(12,569)	[3,016]	{1,508}
Kent	163,504	163,504	163,504	163,504	163,709	(32,742)	[7,858]	{3,929}	163,896	(32,779)	[7,867]	{3,933}	164,070	(32,814)	[7,875]	{3,938}
Livingston	44,996	44,996	44,996	44,996	45,068	(9,014)	[2,163]	{1,082}	45,134	(9,027)	[2,166]	{1,083}	45,196	(9,039)	[2,169]	{1,085}
Macomb	222,932	222,932	222,932	222,932	223,150	(44,630)	[10,711]	{5,356}	223,352	(44,670)	[10,721]	{5,360}	223,530	(44,706)	[10,729]	{5,365}
Monroe	37,373	37,373	37,373	37,373	37,425	(7,485)	[1,796]	{898}	37,472	(7,494)	[1,799]	{899}	37,515	(7,503)	[1,801]	{900}
Oakland	280,254	280,254	280,254	280,254	280,770	(56,154)	[13,477]	{6,738}	281,253	(56,251)	[13,500]	{6,750}	281,703	(56,341)	[13,522]	{6,761}
Washtenaw	71,894	71,894	71,894	71,894	72,121	(14,424)	[3,462]	{1,731}	72,334	(14,467)	[3,472]	{1,736}	72,540	(14,508)	[3,482]	{1,741}
Wayne	390,140	390,140	390,140	390,140	390,521	(78,104)	[18,745]	{9,372}	390,847	(78,169)	[18,761]	{9,380}	391,151	(78,230)	[18,775]	{9,388}

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.