

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

Date: 3/1/21

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 3/1/21 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.

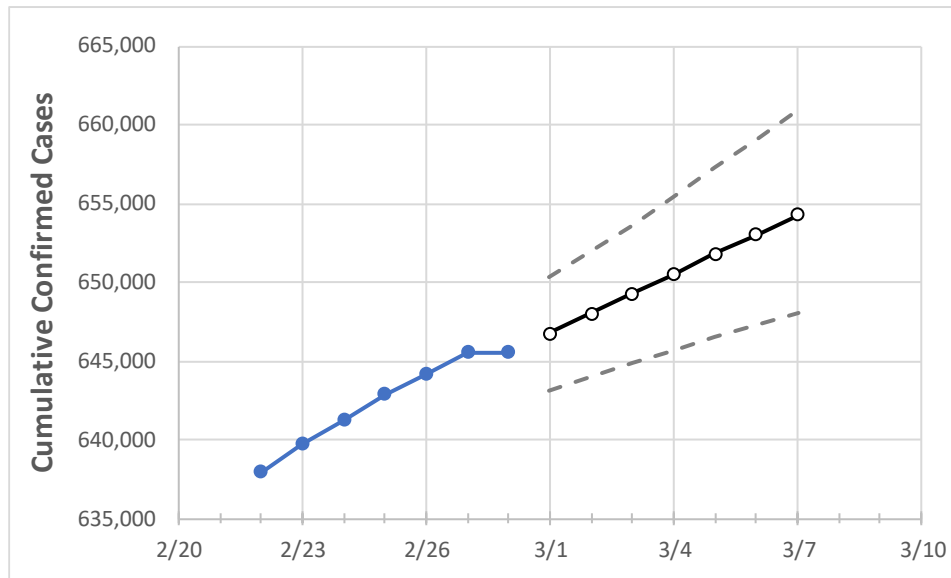
IEM's Modeling Lead

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:							
	2/25	2/26	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	
Michigan	642,868	644,125	645,550	645,550	646,779	648,007	649,260	650,514	651,791	653,034	654,295	

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:						
	2/25	2/26	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7
Genesee	25,410	25,487	25,546	25,546	25,597	25,648	25,700	25,754	25,811	25,866	25,922
Ingham	16,303	16,334	16,387	16,387	16,419	16,451	16,481	16,510	16,539	16,569	16,598
Kent	51,582	51,656	51,718	51,718	51,792	51,865	51,937	52,010	52,083	52,154	52,225
Livingston	10,246	10,263	10,290	10,290	10,310	10,331	10,352	10,373	10,393	10,414	10,436
Macomb	58,657	58,758	58,935	58,935	59,049	59,167	59,282	59,397	59,515	59,635	59,753
Monroe	9,705	9,733	9,772	9,772	9,792	9,813	9,832	9,853	9,873	9,894	9,915
Oakland	74,481	74,607	74,754	74,754	74,884	75,016	75,146	75,279	75,408	75,533	75,662
Washtenaw	18,570	18,624	18,684	18,684	18,735	18,784	18,833	18,881	18,928	18,975	19,022
Wayne	101,343	101,504	101,777	101,777	101,927	102,079	102,229	102,377	102,525	102,675	102,819

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:											
	2/25	2/26	2/27	2/28	3/2				3/4				3/6			
Genesee	25,410	25,487	25,546	25,546	25,648	(5,130)	[1,231]	{616}	25,754	(5,151)	[1,236]	{618}	25,866	(5,173)	[1,242]	{621}
Ingham	16,303	16,334	16,387	16,387	16,451	(3,290)	[790]	{395}	16,510	(3,302)	[792]	{396}	16,569	(3,314)	[795]	{398}
Kent	51,582	51,656	51,718	51,718	51,865	(10,373)	[2,490]	{1,245}	52,010	(10,402)	[2,496]	{1,248}	52,154	(10,431)	[2,503]	{1,252}
Livingston	10,246	10,263	10,290	10,290	10,331	(2,066)	[496]	{248}	10,373	(2,075)	[498]	{249}	10,414	(2,083)	[500]	{250}
Macomb	58,657	58,758	58,935	58,935	59,167	(11,833)	[2,840]	{1,420}	59,397	(11,879)	[2,851]	{1,426}	59,635	(11,927)	[2,863]	{1,431}
Monroe	9,705	9,733	9,772	9,772	9,813	(1,963)	[471]	{236}	9,853	(1,971)	[473]	{236}	9,894	(1,979)	[475]	{237}
Oakland	74,481	74,607	74,754	74,754	75,016	(15,003)	[3,601]	{1,800}	75,279	(15,056)	[3,613]	{1,807}	75,533	(15,107)	[3,626]	{1,813}
Washtenaw	18,570	18,624	18,684	18,684	18,784	(3,757)	[902]	{451}	18,881	(3,776)	[906]	{453}	18,975	(3,795)	[911]	{455}
Wayne	101,343	101,504	101,777	101,777	102,079	(20,416)	[4,900]	{2,450}	102,377	(20,475)	[4,914]	{2,457}	102,675	(20,535)	[4,928]	{2,464}

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.