

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

Date: 3/3/21

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 3/3/21 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.**

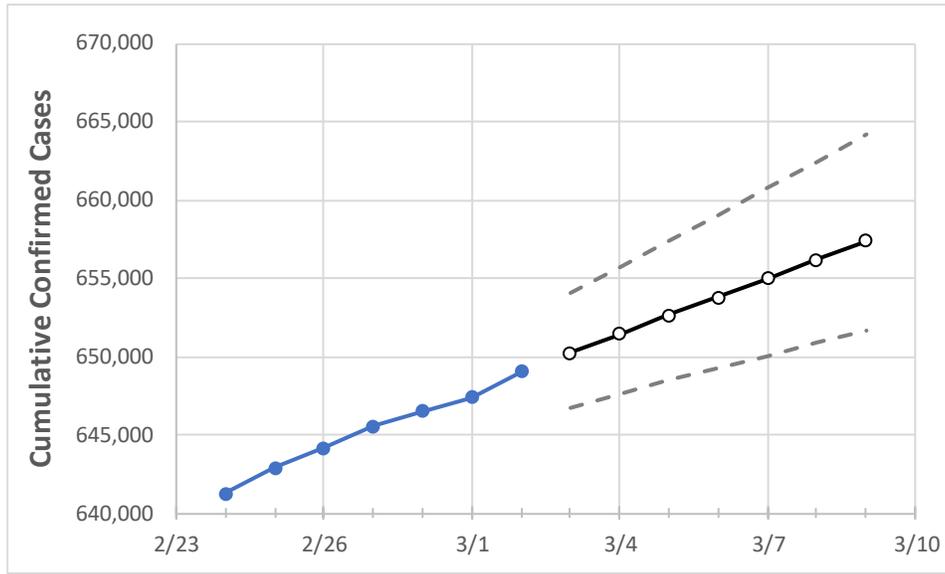
### IEM's Modeling Lead

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:					
	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	
Michigan	645,550	646,483	647,415	649,057	650,242	651,435	652,615	653,803	654,990	656,194	657,371	

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:							
	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	
Genesee	25,546	25,601	25,656	25,753	25,825	25,900	25,977	26,057	26,142	26,227	26,319	
Ingham	16,387	16,413	16,439	16,482	16,515	16,547	16,580	16,611	16,640	16,671	16,700	
Kent	51,718	51,782	51,846	51,949	52,026	52,101	52,178	52,252	52,323	52,397	52,471	
Livingston	10,290	10,313	10,336	10,369	10,393	10,418	10,443	10,468	10,493	10,518	10,543	
Macomb	58,935	59,027	59,119	59,289	59,424	59,559	59,696	59,837	59,981	60,128	60,280	
Monroe	9,772	9,789	9,806	9,854	9,878	9,903	9,929	9,954	9,980	10,007	10,035	
Oakland	74,754	74,864	74,973	75,147	75,284	75,420	75,557	75,694	75,831	75,965	76,100	
Washtenaw	18,684	18,716	18,748	18,776	18,818	18,858	18,898	18,936	18,975	19,013	19,047	
Wayne	101,777	101,950	102,122	102,411	102,618	102,831	103,049	103,265	103,483	103,710	103,940	

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:											
	2/27	2/28	3/1	3/2	3/4			3/6			3/8					
Genesee	25,546	25,601	25,656	25,753	25,900	(5,180)	[1,243]	{622}	26,057	(5,211)	[1,251]	{625}	26,227	(5,245)	[1,259]	{629}
Ingham	16,387	16,413	16,439	16,482	16,547	(3,309)	[794]	{397}	16,611	(3,322)	[797]	{399}	16,671	(3,334)	[800]	{400}
Kent	51,718	51,782	51,846	51,949	52,101	(10,420)	[2,501]	{1,250}	52,252	(10,450)	[2,508]	{1,254}	52,397	(10,479)	[2,515]	{1,258}
Livingston	10,290	10,313	10,336	10,369	10,418	(2,084)	[500]	{250}	10,468	(2,094)	[502]	{251}	10,518	(2,104)	[505]	{252}
Macomb	58,935	59,027	59,119	59,289	59,559	(11,912)	[2,859]	{1,429}	59,837	(11,967)	[2,872]	{1,436}	60,128	(12,026)	[2,886]	{1,443}
Monroe	9,772	9,789	9,806	9,854	9,903	(1,981)	[475]	{238}	9,954	(1,991)	[478]	{239}	10,007	(2,001)	[480]	{240}
Oakland	74,754	74,864	74,973	75,147	75,420	(15,084)	[3,620]	{1,810}	75,694	(15,139)	[3,633]	{1,817}	75,965	(15,193)	[3,646]	{1,823}
Washtenaw	18,684	18,716	18,748	18,776	18,858	(3,772)	[905]	{453}	18,936	(3,787)	[909]	{454}	19,013	(3,803)	[913]	{456}
Wayne	101,777	101,950	102,122	102,411	102,831	(20,566)	[4,936]	{2,468}	103,265	(20,653)	[4,957]	{2,478}	103,710	(20,742)	[4,978]	{2,489}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at [bryan.koon@iem.com](mailto:bryan.koon@iem.com) or 850-519-7966 or Stephanie Tennyson at [stephanie.tennyson@iem.com](mailto:stephanie.tennyson@iem.com) or 202-309-4257.