

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

Date: 2/25/21

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 2/25/21 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.**

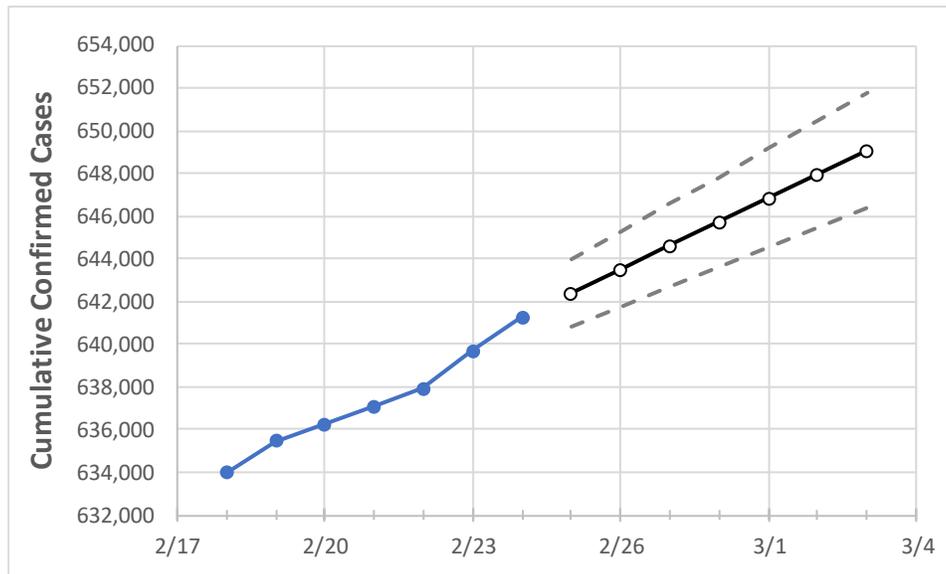
### IEM's Modeling Lead

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:							
	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2	3/3	
Michigan	637,099	637,928	639,712	641,270	642,395	643,498	644,616	645,727	646,831	647,938	649,054	

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:							
	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2	3/3	
Genesee	25,153	25,177	25,272	25,332	25,371	25,410	25,450	25,488	25,528	25,569	25,608	
Ingham	16,114	16,138	16,215	16,257	16,290	16,324	16,356	16,388	16,420	16,449	16,480	
Kent	51,205	51,260	51,381	51,481	51,555	51,628	51,699	51,770	51,840	51,909	51,975	
Livingston	10,131	10,148	10,182	10,208	10,226	10,244	10,262	10,279	10,297	10,314	10,331	
Macomb	58,087	58,172	58,347	58,489	58,584	58,680	58,774	58,871	58,967	59,059	59,156	
Monroe	9,627	9,639	9,664	9,691	9,706	9,720	9,734	9,748	9,761	9,774	9,787	
Oakland	73,833	73,922	74,155	74,318	74,433	74,548	74,659	74,770	74,879	74,985	75,094	
Washtenaw	18,320	18,361	18,424	18,489	18,541	18,592	18,641	18,689	18,735	18,781	18,825	
Wayne	100,507	100,642	100,878	101,094	101,249	101,403	101,558	101,712	101,867	102,020	102,172	

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:											
	2/21	2/22	2/23	2/24	2/26				2/28				3/2			
Genesee	25,153	25,177	25,272	25,332	25,410	(5,082)	[1,220]	{610}	25,488	(5,098)	[1,223]	{612}	25,569	(5,114)	[1,227]	{614}
Ingham	16,114	16,138	16,215	16,257	16,324	(3,265)	[784]	{392}	16,388	(3,278)	[787]	{393}	16,449	(3,290)	[790]	{395}
Kent	51,205	51,260	51,381	51,481	51,628	(10,326)	[2,478]	{1,239}	51,770	(10,354)	[2,485]	{1,242}	51,909	(10,382)	[2,492]	{1,246}
Livingston	10,131	10,148	10,182	10,208	10,244	(2,049)	[492]	{246}	10,279	(2,056)	[493]	{247}	10,314	(2,063)	[495]	{248}
Macomb	58,087	58,172	58,347	58,489	58,680	(11,736)	[2,817]	{1,408}	58,871	(11,774)	[2,826]	{1,413}	59,059	(11,812)	[2,835]	{1,417}
Monroe	9,627	9,639	9,664	9,691	9,720	(1,944)	[467]	{233}	9,748	(1,950)	[468]	{234}	9,774	(1,955)	[469]	{235}
Oakland	73,833	73,922	74,155	74,318	74,548	(14,910)	[3,578]	{1,789}	74,770	(14,954)	[3,589]	{1,794}	74,985	(14,997)	[3,599]	{1,800}
Washtenaw	18,320	18,361	18,424	18,489	18,592	(3,718)	[892]	{446}	18,689	(3,738)	[897]	{449}	18,781	(3,756)	[901]	{451}
Wayne	100,507	100,642	100,878	101,094	101,403	(20,281)	[4,867]	{2,434}	101,712	(20,342)	[4,882]	{2,441}	102,020	(20,404)	[4,897]	{2,448}

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.