

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

Date: 12/8/20

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 12/8/20 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.**

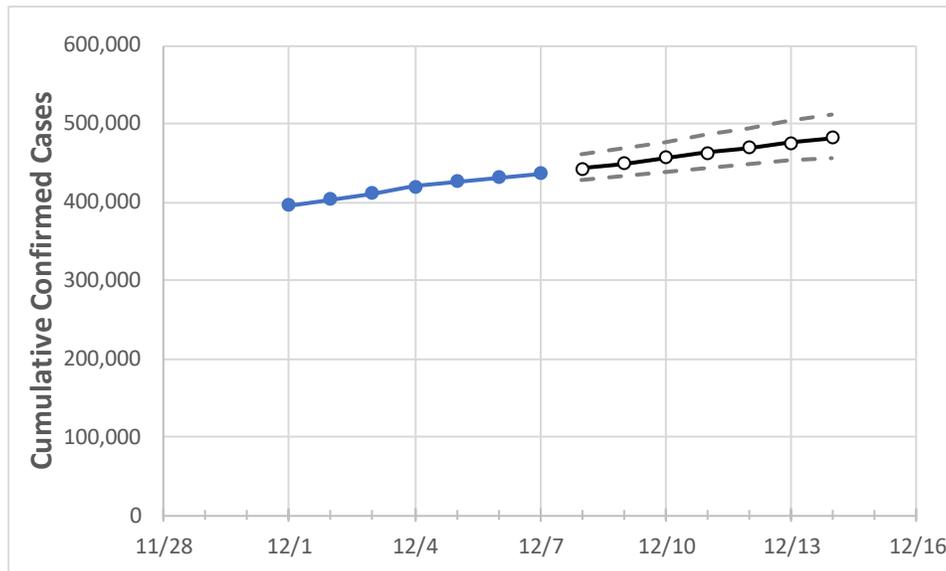
### IEM's Modeling Lead

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:							
	12/4	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14	
Michigan	420,268	426,576	431,488	436,400	443,007	449,593	456,158	462,702	469,224	475,723	482,201	

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 20%, and are often within 10%, of actual confirmed cases.

### Michigan Counties

	Actual Confirmed Cases On:				Projected Cases For:							
	12/4	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14	
Genesee	16,325	16,694	16,921	17,148	17,433	17,718	18,004	18,291	18,578	18,866	19,155	
Ingham	9,831	9,940	10,045	10,149	10,292	10,435	10,577	10,718	10,859	10,999	11,138	
Kent	35,826	36,183	36,594	37,005	37,472	37,932	38,387	38,835	39,277	39,714	40,144	
Livingston	6,181	6,263	6,350	6,436	6,548	6,659	6,771	6,882	6,993	7,103	7,213	
Macomb	40,660	41,276	41,691	42,105	42,724	43,339	43,953	44,563	45,171	45,777	46,379	
Monroe	5,859	5,976	6,055	6,134	6,238	6,341	6,443	6,544	6,644	6,744	6,843	
Oakland	50,014	50,593	51,031	51,468	52,115	52,756	53,392	54,022	54,647	55,267	55,882	
Washtenaw	10,787	10,893	11,025	11,156	11,288	11,420	11,551	11,682	11,813	11,943	12,074	
Wayne	69,382	70,231	70,866	71,501	72,433	73,370	74,309	75,253	76,200	77,151	78,105	

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:											
	12/4	12/5	12/6	12/7	12/9				12/11				12/13			
Genesee	16,325	16,694	16,921	17,148	17,718	(3,544)	[850]	{425}	18,291	(3,658)	[878]	{439}	18,866	(3,773)	[906]	{453}
Ingham	9,831	9,940	10,045	10,149	10,435	(2,087)	[501]	{250}	10,718	(2,144)	[514]	{257}	10,999	(2,200)	[528]	{264}
Kent	35,826	36,183	36,594	37,005	37,932	(7,586)	[1,821]	{910}	38,835	(7,767)	[1,864]	{932}	39,714	(7,943)	[1,906]	{953}
Livingston	6,181	6,263	6,350	6,436	6,659	(1,332)	[320]	{160}	6,882	(1,376)	[330]	{165}	7,103	(1,421)	[341]	{170}
Macomb	40,660	41,276	41,691	42,105	43,339	(8,668)	[2,080]	{1,040}	44,563	(8,913)	[2,139]	{1,070}	45,777	(9,155)	[2,197]	{1,099}
Monroe	5,859	5,976	6,055	6,134	6,341	(1,268)	[304]	{152}	6,544	(1,309)	[314]	{157}	6,744	(1,349)	[324]	{162}
Oakland	50,014	50,593	51,031	51,468	52,756	(10,551)	[2,532]	{1,266}	54,022	(10,804)	[2,593]	{1,297}	55,267	(11,053)	[2,653]	{1,326}
Washtenaw	10,787	10,893	11,025	11,156	11,420	(2,284)	[548]	{274}	11,682	(2,336)	[561]	{280}	11,943	(2,389)	[573]	{287}
Wayne	69,382	70,231	70,866	71,501	73,370	(14,674)	[3,522]	{1,761}	75,253	(15,051)	[3,612]	{1,806}	77,151	(15,430)	[3,703]	{1,852}

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.