

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

Date: 3/22/21

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 3/22/21 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.**

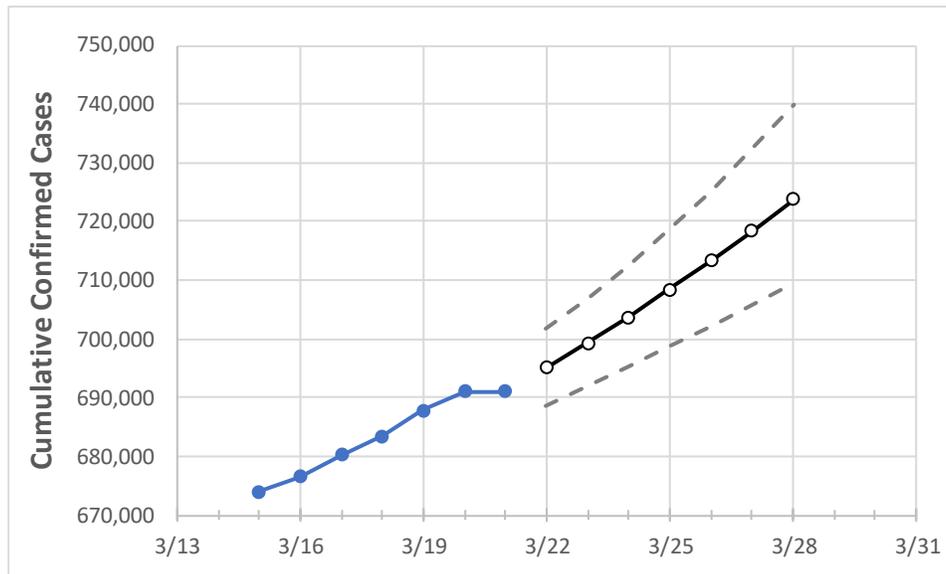
### IEM's Modeling Lead

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:						
	3/18	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	
Michigan	683,398	687,815	691,070	691,070	695,053	699,241	703,656	708,429	713,305	718,461	723,870	

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:							
	3/18	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	
Genesee	27,421	27,628	27,796	27,796	27,963	28,137	28,320	28,517	28,719	28,934	29,152	
Ingham	17,518	17,666	17,764	17,764	17,870	17,980	18,096	18,217	18,348	18,485	18,628	
Kent	53,585	53,738	53,878	53,878	54,022	54,170	54,330	54,488	54,652	54,821	54,997	
Livingston	11,090	11,174	11,228	11,228	11,299	11,370	11,446	11,527	11,611	11,696	11,788	
Macomb	63,448	64,079	64,525	64,525	64,988	65,480	65,995	66,551	67,124	67,744	68,383	
Monroe	10,595	10,651	10,716	10,716	10,779	10,847	10,917	10,990	11,067	11,145	11,226	
Oakland	79,397	79,999	80,481	80,481	80,993	81,547	82,121	82,721	83,377	84,083	84,800	
Washtenaw	19,524	19,604	19,654	19,654	19,705	19,757	19,808	19,861	19,912	19,965	20,017	
Wayne	107,988	108,743	109,236	109,236	109,832	110,445	111,092	111,769	112,495	113,257	114,063	

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:											
	3/18	3/19	3/20	3/21	3/23				3/25				3/27			
Genesee	27,421	27,628	27,796	27,796	28,137	(5,627)	[1,351]	{675}	28,517	(5,703)	[1,369]	{684}	28,934	(5,787)	[1,389]	{694}
Ingham	17,518	17,666	17,764	17,764	17,980	(3,596)	[863]	{432}	18,217	(3,643)	[874]	{437}	18,485	(3,697)	[887]	{444}
Kent	53,585	53,738	53,878	53,878	54,170	(10,834)	[2,600]	{1,300}	54,488	(10,898)	[2,615]	{1,308}	54,821	(10,964)	[2,631]	{1,316}
Livingston	11,090	11,174	11,228	11,228	11,370	(2,274)	[546]	{273}	11,527	(2,305)	[553]	{277}	11,696	(2,339)	[561]	{281}
Macomb	63,448	64,079	64,525	64,525	65,480	(13,096)	[3,143]	{1,572}	66,551	(13,310)	[3,194]	{1,597}	67,744	(13,549)	[3,252]	{1,626}
Monroe	10,595	10,651	10,716	10,716	10,847	(2,169)	[521]	{260}	10,990	(2,198)	[528]	{264}	11,145	(2,229)	[535]	{267}
Oakland	79,397	79,999	80,481	80,481	81,547	(16,309)	[3,914]	{1,957}	82,721	(16,544)	[3,971]	{1,985}	84,083	(16,817)	[4,036]	{2,018}
Washtenaw	19,524	19,604	19,654	19,654	19,757	(3,951)	[948]	{474}	19,861	(3,972)	[953]	{477}	19,965	(3,993)	[958]	{479}
Wayne	107,988	108,743	109,236	109,236	110,445	(22,089)	[5,301]	{2,651}	111,769	(22,354)	[5,365]	{2,682}	113,257	(22,651)	[5,436]	{2,718}

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.