

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

Date: 4/29/21

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 4/29/21 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.**

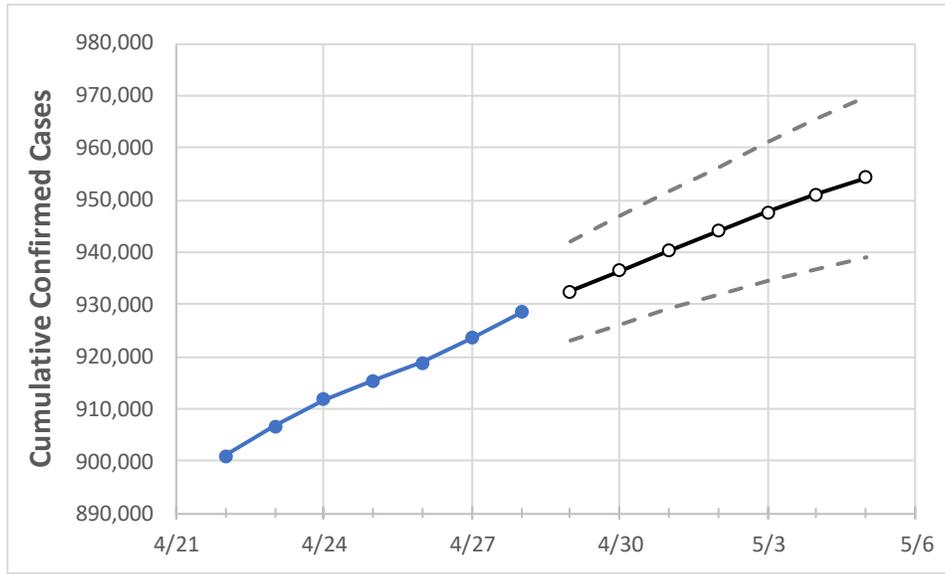
### IEM's Modeling Lead

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:							
	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3	5/4	5/5	
Michigan	915,340	918,880	923,464	928,407	932,531	936,546	940,297	944,022	947,599	951,100	954,384	

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:							
	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3	5/4	5/5	
Genesee	38,553	38,720	38,927	39,178	39,376	39,570	39,754	39,933	40,101	40,262	40,413	
Ingham	23,258	23,351	23,428	23,518	23,601	23,676	23,751	23,822	23,892	23,960	24,025	
Kent	66,603	66,882	67,169	67,549	67,861	68,166	68,462	68,747	69,032	69,308	69,582	
Livingston	15,396	15,471	15,553	15,653	15,724	15,793	15,859	15,926	15,986	16,043	16,097	
Macomb	92,581	92,958	93,420	93,844	94,276	94,701	95,106	95,492	95,863	96,222	96,559	
Monroe	14,212	14,248	14,361	14,429	14,484	14,539	14,589	14,638	14,685	14,731	14,777	
Oakland	108,484	108,858	109,374	109,933	110,411	110,854	111,289	111,721	112,146	112,535	112,906	
Washtenaw	24,994	25,057	25,136	25,237	25,308	25,375	25,438	25,497	25,554	25,606	25,656	
Wayne	150,976	151,702	152,469	153,305	154,064	154,786	155,489	156,167	156,818	157,428	158,055	

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:											
	4/25	4/26	4/27	4/28	4/30				5/2				5/4			
Genesee	38,553	38,720	38,927	39,178	39,570	(7,914)	[1,899]	{950}	39,933	(7,987)	[1,917]	{958}	40,262	(8,052)	[1,933]	{966}
Ingham	23,258	23,351	23,428	23,518	23,676	(4,735)	[1,136]	{568}	23,822	(4,764)	[1,143]	{572}	23,960	(4,792)	[1,150]	{575}
Kent	66,603	66,882	67,169	67,549	68,166	(13,633)	[3,272]	{1,636}	68,747	(13,749)	[3,300]	{1,650}	69,308	(13,862)	[3,327]	{1,663}
Livingston	15,396	15,471	15,553	15,653	15,793	(3,159)	[758]	{379}	15,926	(3,185)	[764]	{382}	16,043	(3,209)	[770]	{385}
Macomb	92,581	92,958	93,420	93,844	94,701	(18,940)	[4,546]	{2,273}	95,492	(19,098)	[4,584]	{2,292}	96,222	(19,244)	[4,619]	{2,309}
Monroe	14,212	14,248	14,361	14,429	14,539	(2,908)	[698]	{349}	14,638	(2,928)	[703]	{351}	14,731	(2,946)	[707]	{354}
Oakland	108,484	108,858	109,374	109,933	110,854	(22,171)	[5,321]	{2,661}	111,721	(22,344)	[5,363]	{2,681}	112,535	(22,507)	[5,402]	{2,701}
Washtenaw	24,994	25,057	25,136	25,237	25,375	(5,075)	[1,218]	{609}	25,497	(5,099)	[1,224]	{612}	25,606	(5,121)	[1,229]	{615}
Wayne	150,976	151,702	152,469	153,305	154,786	(30,957)	[7,430]	{3,715}	156,167	(31,233)	[7,496]	{3,748}	157,428	(31,486)	[7,557]	{3,778}

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.