

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

Date: 4/15/21

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 4/15/21 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.**

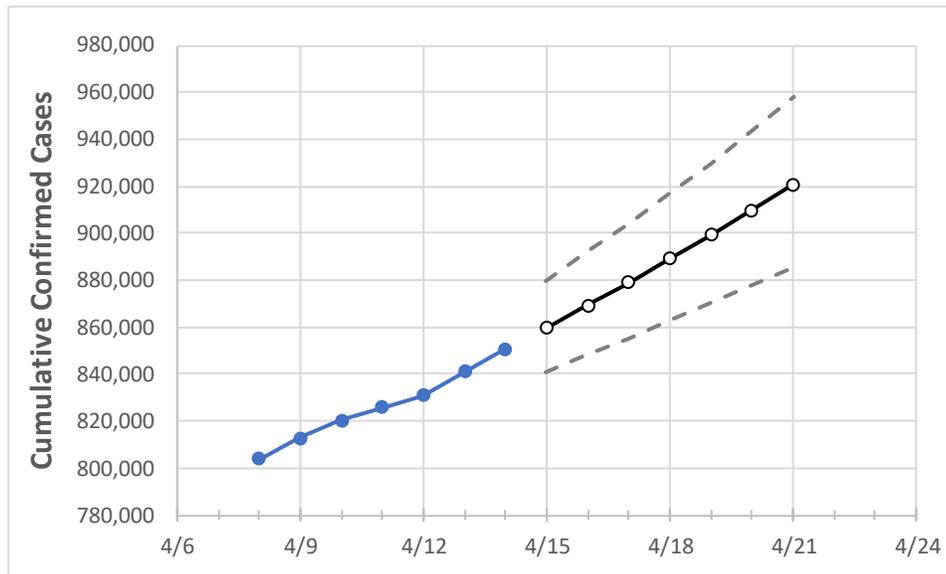
### IEM's Modeling Lead

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:							
	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	4/21	
Michigan	825,681	830,957	841,234	850,583	859,727	869,303	878,942	888,984	899,256	909,985	920,933	

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:							
	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	4/21	
Genesee	34,144	34,423	34,852	35,259	35,695	36,148	36,608	37,082	37,571	38,070	38,585	
Ingham	21,383	21,538	21,733	21,945	22,146	22,350	22,555	22,767	22,977	23,194	23,413	
Kent	60,634	60,875	61,478	62,264	62,813	63,389	63,986	64,612	65,287	65,975	66,690	
Livingston	13,769	13,891	14,102	14,314	14,500	14,691	14,888	15,092	15,306	15,527	15,754	
Macomb	82,472	83,081	84,328	85,223	86,287	87,357	88,429	89,528	90,642	91,765	92,923	
Monroe	12,867	12,957	13,209	13,326	13,486	13,653	13,822	13,995	14,179	14,368	14,566	
Oakland	97,684	98,298	99,595	100,691	101,755	102,853	103,988	105,159	106,346	107,549	108,790	
Washtenaw	22,868	22,989	23,360	23,584	23,844	24,104	24,375	24,659	24,955	25,264	25,596	
Wayne	134,208	135,247	137,370	139,010	140,838	142,735	144,693	146,708	148,841	151,035	153,269	

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:											
	4/11	4/12	4/13	4/14	4/16				4/18				4/20			
Genesee	34,144	34,423	34,852	35,259	36,148	(7,230)	[1,735]	{868}	37,082	(7,416)	[1,780]	{890}	38,070	(7,614)	[1,827]	{914}
Ingham	21,383	21,538	21,733	21,945	22,350	(4,470)	[1,073]	{536}	22,767	(4,553)	[1,093]	{546}	23,194	(4,639)	[1,113]	{557}
Kent	60,634	60,875	61,478	62,264	63,389	(12,678)	[3,043]	{1,521}	64,612	(12,922)	[3,101]	{1,551}	65,975	(13,195)	[3,167]	{1,583}
Livingston	13,769	13,891	14,102	14,314	14,691	(2,938)	[705]	{353}	15,092	(3,018)	[724]	{362}	15,527	(3,105)	[745]	{373}
Macomb	82,472	83,081	84,328	85,223	87,357	(17,471)	[4,193]	{2,097}	89,528	(17,906)	[4,297]	{2,149}	91,765	(18,353)	[4,405]	{2,202}
Monroe	12,867	12,957	13,209	13,326	13,653	(2,731)	[655]	{328}	13,995	(2,799)	[672]	{336}	14,368	(2,874)	[690]	{345}
Oakland	97,684	98,298	99,595	100,691	102,853	(20,571)	[4,937]	{2,468}	105,159	(21,032)	[5,048]	{2,524}	107,549	(21,510)	[5,162]	{2,581}
Washtenaw	22,868	22,989	23,360	23,584	24,104	(4,821)	[1,157]	{578}	24,659	(4,932)	[1,184]	{592}	25,264	(5,053)	[1,213]	{606}
Wayne	134,208	135,247	137,370	139,010	142,735	(28,547)	[6,851]	{3,426}	146,708	(29,342)	[7,042]	{3,521}	151,035	(30,207)	[7,250]	{3,625}

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.