

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

Date: 1/19/21

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 1/19/21 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.**

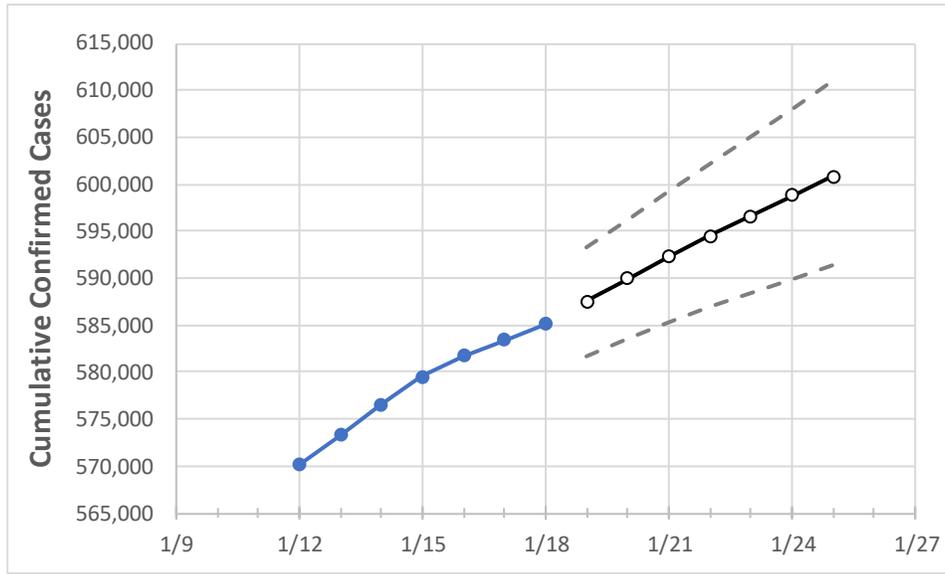
### IEM's Modeling Lead

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:							
	1/15	1/16	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	
Michigan	579,574	581,785	583,457	585,128	587,528	589,952	592,251	594,506	596,652	598,780	600,863	

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:							
	1/15	1/16	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	
Genesee	23,383	23,473	23,538	23,602	23,714	23,824	23,932	24,043	24,156	24,267	24,376	
Ingham	13,972	14,026	14,091	14,155	14,234	14,313	14,390	14,469	14,549	14,627	14,706	
Kent	47,110	47,241	47,364	47,486	47,674	47,853	48,034	48,210	48,382	48,548	48,712	
Livingston	8,918	8,959	9,002	9,044	9,095	9,147	9,197	9,246	9,293	9,339	9,385	
Macomb	53,252	53,400	53,550	53,699	53,884	54,068	54,246	54,418	54,586	54,758	54,923	
Monroe	8,570	8,603	8,647	8,690	8,739	8,787	8,835	8,881	8,928	8,973	9,016	
Oakland	66,986	67,307	67,491	67,674	67,962	68,240	68,505	68,764	69,016	69,261	69,501	
Washtenaw	15,344	15,413	15,465	15,517	15,603	15,683	15,766	15,849	15,928	16,009	16,085	
Wayne	92,047	92,449	92,713	92,976	93,366	93,756	94,133	94,506	94,864	95,225	95,565	

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:											
	1/15	1/16	1/17	1/18	1/20			1/22			1/24					
Genesee	23,383	23,473	23,538	23,602	23,824	(4,765)	[1,144]	{572}	24,043	(4,809)	[1,154]	{577}	24,267	(4,853)	[1,165]	{582}
Ingham	13,972	14,026	14,091	14,155	14,313	(2,863)	[687]	{344}	14,469	(2,894)	[695]	{347}	14,627	(2,925)	[702]	{351}
Kent	47,110	47,241	47,364	47,486	47,853	(9,571)	[2,297]	{1,148}	48,210	(9,642)	[2,314]	{1,157}	48,548	(9,710)	[2,330]	{1,165}
Livingston	8,918	8,959	9,002	9,044	9,147	(1,829)	[439]	{220}	9,246	(1,849)	[444]	{222}	9,339	(1,868)	[448]	{224}
Macomb	53,252	53,400	53,550	53,699	54,068	(10,814)	[2,595]	{1,298}	54,418	(10,884)	[2,612]	{1,306}	54,758	(10,952)	[2,628]	{1,314}
Monroe	8,570	8,603	8,647	8,690	8,787	(1,757)	[422]	{211}	8,881	(1,776)	[426]	{213}	8,973	(1,795)	[431]	{215}
Oakland	66,986	67,307	67,491	67,674	68,240	(13,648)	[3,276]	{1,638}	68,764	(13,753)	[3,301]	{1,650}	69,261	(13,852)	[3,325]	{1,662}
Washtenaw	15,344	15,413	15,465	15,517	15,683	(3,137)	[753]	{376}	15,849	(3,170)	[761]	{380}	16,009	(3,202)	[768]	{384}
Wayne	92,047	92,449	92,713	92,976	93,756	(18,751)	[4,500]	{2,250}	94,506	(18,901)	[4,536]	{2,268}	95,225	(19,045)	[4,571]	{2,285}

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.