

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

Date: 4/9/21

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 4/9/21 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.**

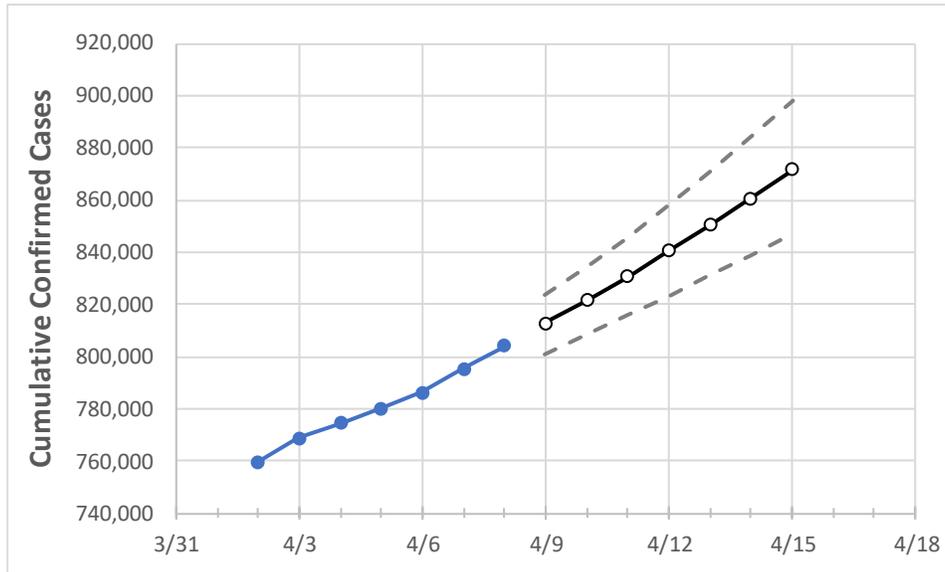
### IEM's Modeling Lead

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:							
	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15	
Michigan	779,974	786,123	795,492	804,031	812,676	821,476	830,784	840,360	850,321	860,742	871,605	

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:							
	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15	
Genesee	31,888	32,130	32,555	33,033	33,429	33,841	34,274	34,724	35,185	35,662	36,155	
Ingham	20,352	20,471	20,643	20,817	21,009	21,202	21,403	21,608	21,815	22,025	22,239	
Kent	58,297	58,601	59,058	59,470	59,911	60,361	60,850	61,357	61,892	62,456	63,032	
Livingston	12,863	12,949	13,179	13,340	13,495	13,655	13,820	13,993	14,168	14,350	14,542	
Macomb	77,281	77,991	79,108	80,050	81,138	82,253	83,376	84,542	85,747	86,966	88,219	
Monroe	12,180	12,272	12,347	12,469	12,594	12,722	12,854	12,989	13,128	13,271	13,415	
Oakland	92,253	93,013	94,190	95,266	96,342	97,453	98,619	99,805	101,037	102,314	103,654	
Washtenaw	21,657	21,871	22,102	22,348	22,569	22,798	23,044	23,300	23,567	23,851	24,150	
Wayne	125,364	126,530	128,394	130,075	131,811	133,633	135,552	137,552	139,643	141,850	144,158	

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:											
	4/5	4/6	4/7	4/8	4/10				4/12				4/14			
Genesee	31,888	32,130	32,555	33,033	33,841	(6,768)	[1,624]	{812}	34,724	(6,945)	[1,667]	{833}	35,662	(7,132)	[1,712]	{856}
Ingham	20,352	20,471	20,643	20,817	21,202	(4,240)	[1,018]	{509}	21,608	(4,322)	[1,037]	{519}	22,025	(4,405)	[1,057]	{529}
Kent	58,297	58,601	59,058	59,470	60,361	(12,072)	[2,897]	{1,449}	61,357	(12,271)	[2,945]	{1,473}	62,456	(12,491)	[2,998]	{1,499}
Livingston	12,863	12,949	13,179	13,340	13,655	(2,731)	[655]	{328}	13,993	(2,799)	[672]	{336}	14,350	(2,870)	[689]	{344}
Macomb	77,281	77,991	79,108	80,050	82,253	(16,451)	[3,948]	{1,974}	84,542	(16,908)	[4,058]	{2,029}	86,966	(17,393)	[4,174]	{2,087}
Monroe	12,180	12,272	12,347	12,469	12,722	(2,544)	[611]	{305}	12,989	(2,598)	[623]	{312}	13,271	(2,654)	[637]	{319}
Oakland	92,253	93,013	94,190	95,266	97,453	(19,491)	[4,678]	{2,339}	99,805	(19,961)	[4,791]	{2,395}	102,314	(20,463)	[4,911]	{2,456}
Washtenaw	21,657	21,871	22,102	22,348	22,798	(4,560)	[1,094]	{547}	23,300	(4,660)	[1,118]	{559}	23,851	(4,770)	[1,145]	{572}
Wayne	125,364	126,530	128,394	130,075	133,633	(26,727)	[6,414]	{3,207}	137,552	(27,510)	[6,603]	{3,301}	141,850	(28,370)	[6,809]	{3,404}

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.