

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

Date: 4/16/21

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 4/16/21 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.**

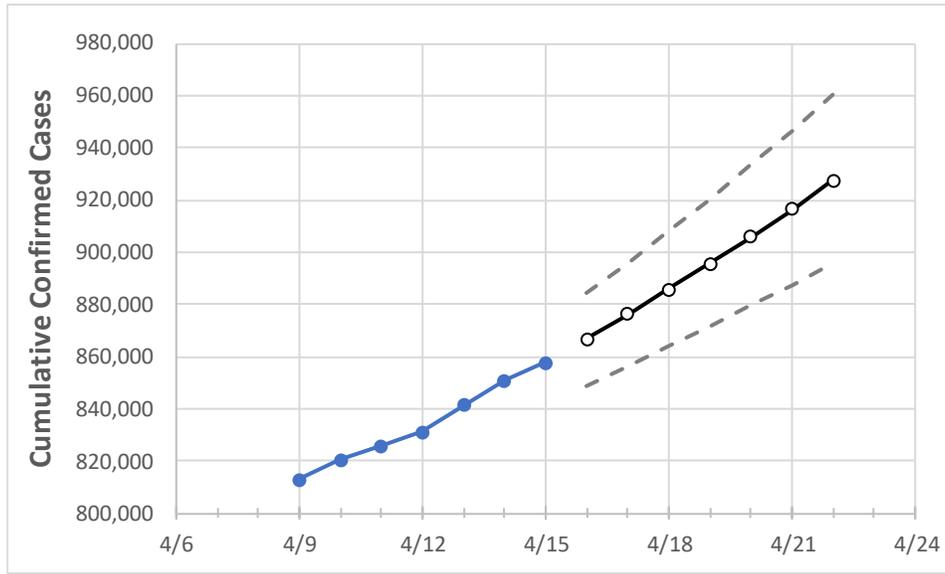
### IEM's Modeling Lead

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:							
	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	4/21	4/22	
Michigan	830,957	841,234	850,583	857,774	866,830	876,116	885,759	895,744	905,883	916,474	927,297	

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:							
	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	4/21	4/22	
Genesee	34,423	34,852	35,259	35,662	36,102	36,549	37,009	37,490	37,978	38,479	39,006	
Ingham	21,538	21,733	21,945	22,097	22,288	22,480	22,675	22,874	23,077	23,281	23,483	
Kent	60,875	61,478	62,264	62,643	63,185	63,752	64,338	64,950	65,576	66,227	66,927	
Livingston	13,891	14,102	14,314	14,418	14,590	14,769	14,953	15,142	15,337	15,542	15,749	
Macomb	83,081	84,328	85,223	85,995	87,026	88,066	89,118	90,179	91,263	92,372	93,464	
Monroe	12,957	13,209	13,326	13,420	13,569	13,728	13,888	14,056	14,221	14,394	14,576	
Oakland	98,298	99,595	100,691	101,670	102,735	103,841	104,992	106,143	107,325	108,505	109,739	
Washtenaw	22,989	23,360	23,584	23,763	24,014	24,275	24,541	24,819	25,108	25,402	25,716	
Wayne	135,247	137,370	139,010	140,324	142,089	143,916	145,829	147,818	149,854	151,929	154,059	

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:											
	4/12	4/13	4/14	4/15	4/17				4/19				4/21			
Genesee	34,423	34,852	35,259	35,662	36,549	(7,310)	[1,754]	{877}	37,490	(7,498)	[1,800]	{900}	38,479	(7,696)	[1,847]	{923}
Ingham	21,538	21,733	21,945	22,097	22,480	(4,496)	[1,079]	{540}	22,874	(4,575)	[1,098]	{549}	23,281	(4,656)	[1,118]	{559}
Kent	60,875	61,478	62,264	62,643	63,752	(12,750)	[3,060]	{1,530}	64,950	(12,990)	[3,118]	{1,559}	66,227	(13,245)	[3,179]	{1,589}
Livingston	13,891	14,102	14,314	14,418	14,769	(2,954)	[709]	{354}	15,142	(3,028)	[727]	{363}	15,542	(3,108)	[746]	{373}
Macomb	83,081	84,328	85,223	85,995	88,066	(17,613)	[4,227]	{2,114}	90,179	(18,036)	[4,329]	{2,164}	92,372	(18,474)	[4,434]	{2,217}
Monroe	12,957	13,209	13,326	13,420	13,728	(2,746)	[659]	{329}	14,056	(2,811)	[675]	{337}	14,394	(2,879)	[691]	{345}
Oakland	98,298	99,595	100,691	101,670	103,841	(20,768)	[4,984]	{2,492}	106,143	(21,229)	[5,095]	{2,547}	108,505	(21,701)	[5,208]	{2,604}
Washtenaw	22,989	23,360	23,584	23,763	24,275	(4,855)	[1,165]	{583}	24,819	(4,964)	[1,191]	{596}	25,402	(5,080)	[1,219]	{610}
Wayne	135,247	137,370	139,010	140,324	143,916	(28,783)	[6,908]	{3,454}	147,818	(29,564)	[7,095]	{3,548}	151,929	(30,386)	[7,293]	{3,646}

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.