

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

Date: 4/21/21

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 4/21/21 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.

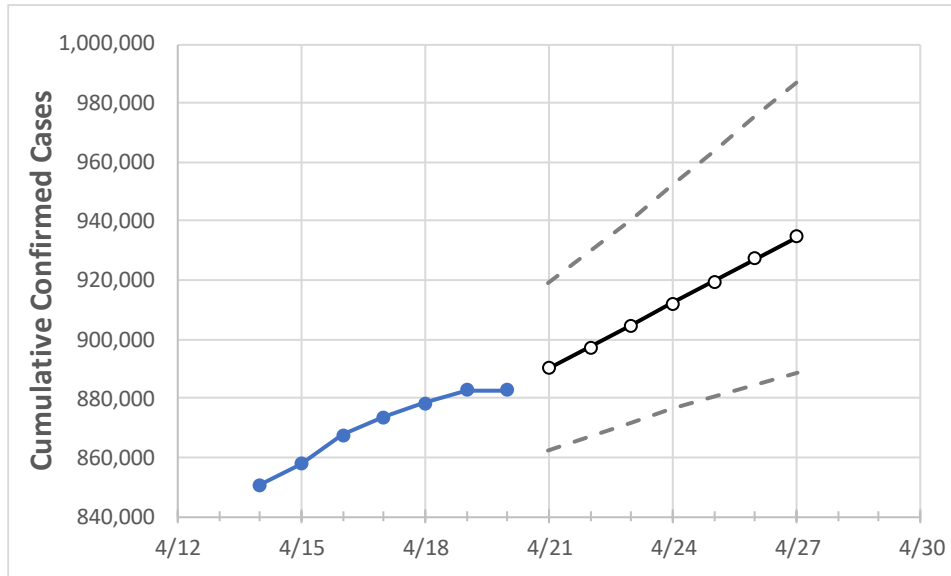
IEM's Modeling Lead

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:							
	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	
Michigan	873,700	878,286	882,871	882,871	890,185	897,405	904,810	912,267	919,632	927,175	934,816	

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:							
	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27	
Genesee	36,499	36,728	36,957	36,957	37,334	37,713	38,100	38,488	38,872	39,248	39,630	
Ingham	22,408	22,509	22,610	22,610	22,758	22,904	23,050	23,191	23,333	23,475	23,617	
Kent	63,710	64,094	64,478	64,478	64,973	65,487	65,999	66,525	67,078	67,645	68,220	
Livingston	14,653	14,756	14,858	14,858	15,005	15,151	15,296	15,441	15,583	15,733	15,881	
Macomb	87,780	88,369	88,958	88,958	89,719	90,439	91,172	91,901	92,601	93,315	94,018	
Monroe	13,620	13,691	13,761	13,761	13,870	13,980	14,089	14,202	14,312	14,422	14,531	
Oakland	103,724	104,184	104,644	104,644	105,497	106,327	107,161	108,004	108,843	109,689	110,502	
Washtenaw	24,138	24,250	24,362	24,362	24,561	24,762	24,969	25,170	25,381	25,590	25,796	
Wayne	143,217	144,070	144,922	144,922	146,319	147,685	149,101	150,527	151,954	153,355	154,720	

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:											
	4/17	4/18	4/19	4/20	4/22				4/24				4/26			
Genesee	36,499	36,728	36,957	36,957	37,713	(7,543)	[1,810]	{905}	38,488	(7,698)	[1,847]	{924}	39,248	(7,850)	[1,884]	{942}
Ingham	22,408	22,509	22,610	22,610	22,904	(4,581)	[1,099]	{550}	23,191	(4,638)	[1,113]	{557}	23,475	(4,695)	[1,127]	{563}
Kent	63,710	64,094	64,478	64,478	65,487	(13,097)	[3,143]	{1,572}	66,525	(13,305)	[3,193]	{1,597}	67,645	(13,529)	[3,247]	{1,623}
Livingston	14,653	14,756	14,858	14,858	15,151	(3,030)	[727]	{364}	15,441	(3,088)	[741]	{371}	15,733	(3,147)	[755]	{378}
Macomb	87,780	88,369	88,958	88,958	90,439	(18,088)	[4,341]	{2,171}	91,901	(18,380)	[4,411]	{2,206}	93,315	(18,663)	[4,479]	{2,240}
Monroe	13,620	13,691	13,761	13,761	13,980	(2,796)	[671]	{336}	14,202	(2,840)	[682]	{341}	14,422	(2,884)	[692]	{346}
Oakland	103,724	104,184	104,644	104,644	106,327	(21,265)	[5,104]	{2,552}	108,004	(21,601)	[5,184]	{2,592}	109,689	(21,938)	[5,265]	{2,633}
Washtenaw	24,138	24,250	24,362	24,362	24,762	(4,952)	[1,189]	{594}	25,170	(5,034)	[1,208]	{604}	25,590	(5,118)	[1,228]	{614}
Wayne	143,217	144,070	144,922	144,922	147,685	(29,537)	[7,089]	{3,544}	150,527	(30,105)	[7,225]	{3,613}	153,355	(30,671)	[7,361]	{3,681}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.