

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

Date: 4/8/21

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 4/8/21 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.

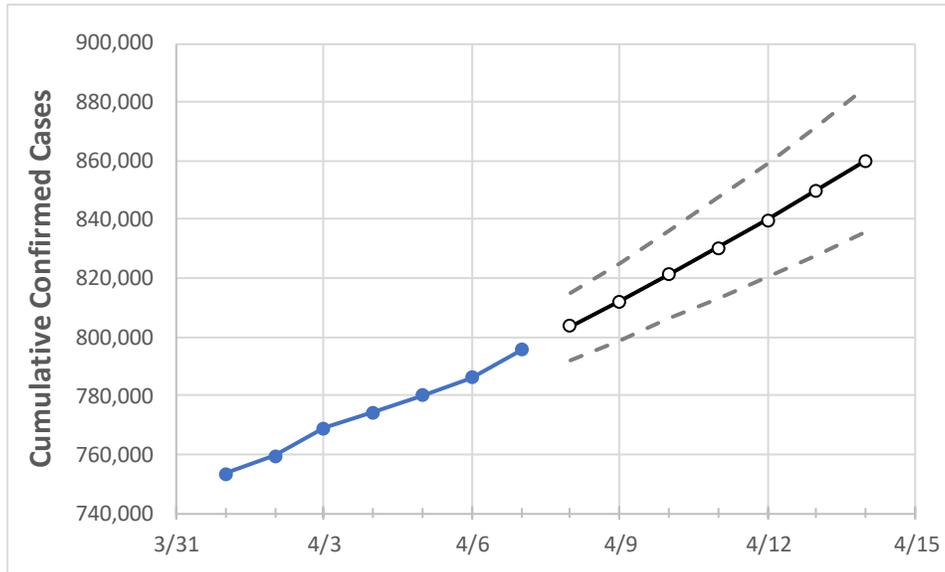
IEM's Modeling Lead

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:							
	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14	
Michigan	774,433	779,974	786,123	795,492	803,730	812,258	821,121	830,374	839,946	849,939	860,223	

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:							
	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14	
Genesee	31,649	31,888	32,130	32,555	32,906	33,271	33,644	34,034	34,425	34,831	35,249	
Ingham	20,194	20,352	20,471	20,643	20,832	21,025	21,223	21,425	21,632	21,842	22,047	
Kent	58,019	58,297	58,601	59,058	59,480	59,928	60,391	60,867	61,379	61,906	62,450	
Livingston	12,747	12,863	12,949	13,179	13,326	13,480	13,639	13,805	13,976	14,152	14,336	
Macomb	76,537	77,281	77,991	79,108	80,187	81,295	82,439	83,634	84,839	86,073	87,352	
Monroe	12,097	12,180	12,272	12,347	12,473	12,604	12,738	12,882	13,027	13,186	13,339	
Oakland	91,436	92,253	93,013	94,190	95,211	96,263	97,350	98,479	99,652	100,872	102,110	
Washtenaw	21,548	21,657	21,871	22,102	22,300	22,508	22,726	22,953	23,191	23,440	23,698	
Wayne	124,168	125,364	126,530	128,394	130,016	131,720	133,520	135,378	137,351	139,406	141,554	

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:											
	4/4	4/5	4/6	4/7	4/9				4/11				4/13			
Genesee	31,649	31,888	32,130	32,555	33,271	(6,654)	[1,597]	{799}	34,034	(6,807)	[1,634]	{817}	34,831	(6,966)	[1,672]	{836}
Ingham	20,194	20,352	20,471	20,643	21,025	(4,205)	[1,009]	{505}	21,425	(4,285)	[1,028]	{514}	21,842	(4,368)	[1,048]	{524}
Kent	58,019	58,297	58,601	59,058	59,928	(11,986)	[2,877]	{1,438}	60,867	(12,173)	[2,922]	{1,461}	61,906	(12,381)	[2,972]	{1,486}
Livingston	12,747	12,863	12,949	13,179	13,480	(2,696)	[647]	{324}	13,805	(2,761)	[663]	{331}	14,152	(2,830)	[679]	{340}
Macomb	76,537	77,281	77,991	79,108	81,295	(16,259)	[3,902]	{1,951}	83,634	(16,727)	[4,014]	{2,007}	86,073	(17,215)	[4,131]	{2,066}
Monroe	12,097	12,180	12,272	12,347	12,604	(2,521)	[605]	{302}	12,882	(2,576)	[618]	{309}	13,186	(2,637)	[633]	{316}
Oakland	91,436	92,253	93,013	94,190	96,263	(19,253)	[4,621]	{2,310}	98,479	(19,696)	[4,727]	{2,363}	100,872	(20,174)	[4,842]	{2,421}
Washtenaw	21,548	21,657	21,871	22,102	22,508	(4,502)	[1,080]	{540}	22,953	(4,591)	[1,102]	{551}	23,440	(4,688)	[1,125]	{563}
Wayne	124,168	125,364	126,530	128,394	131,720	(26,344)	[6,323]	{3,161}	135,378	(27,076)	[6,498]	{3,249}	139,406	(27,881)	[6,691]	{3,346}

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.