

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

Date: 4/5/21

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 4/5/21 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.

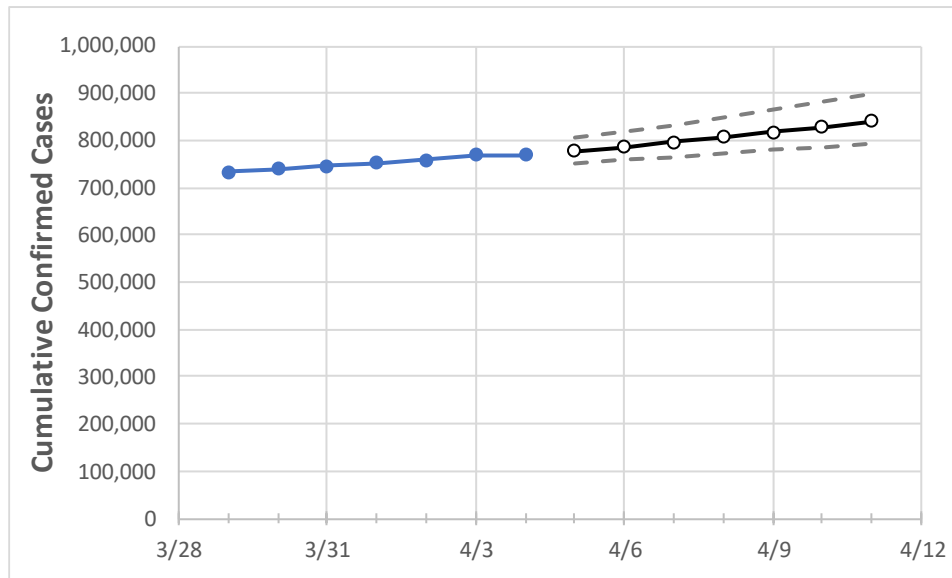
IEM's Modeling Lead

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:						
	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11
Michigan	753,449	759,600	768,892	768,892	777,506	786,696	796,277	806,442	817,283	828,639	840,401

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:							
	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	
Genesee	30,727	31,028	31,410	31,410	31,801	32,202	32,637	33,083	33,560	34,058	34,587	
Ingham	19,676	19,878	20,036	20,036	20,277	20,527	20,789	21,057	21,342	21,641	21,953	
Kent	56,914	57,265	57,741	57,741	58,205	58,699	59,222	59,784	60,387	61,033	61,726	
Livingston	12,425	12,507	12,631	12,631	12,778	12,929	13,090	13,263	13,440	13,628	13,823	
Macomb	73,604	74,405	75,793	75,793	77,125	78,530	80,027	81,606	83,314	85,118	86,992	
Monroe	11,675	11,879	12,013	12,013	12,138	12,270	12,413	12,556	12,706	12,864	13,029	
Oakland	88,629	89,337	90,618	90,618	91,815	93,070	94,404	95,784	97,259	98,814	100,459	
Washtenaw	21,096	21,259	21,439	21,439	21,645	21,862	22,088	22,333	22,591	22,866	23,161	
Wayne	120,222	121,125	122,971	122,971	124,455	126,037	127,750	129,553	131,465	133,469	135,572	

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:											
	4/1	4/2	4/3	4/4	4/6				4/8				4/10			
Genesee	30,727	31,028	31,410	31,410	32,202	(6,440)	[1,546]	{773}	33,083	(6,617)	[1,588]	{794}	34,058	(6,812)	[1,635]	{817}
Ingham	19,676	19,878	20,036	20,036	20,527	(4,105)	[985]	{493}	21,057	(4,211)	[1,011]	{505}	21,641	(4,328)	[1,039]	{519}
Kent	56,914	57,265	57,741	57,741	58,699	(11,740)	[2,818]	{1,409}	59,784	(11,957)	[2,870]	{1,435}	61,033	(12,207)	[2,930]	{1,465}
Livingston	12,425	12,507	12,631	12,631	12,929	(2,586)	[621]	{310}	13,263	(2,653)	[637]	{318}	13,628	(2,726)	[654]	{327}
Macomb	73,604	74,405	75,793	75,793	78,530	(15,706)	[3,769]	{1,885}	81,606	(16,321)	[3,917]	{1,959}	85,118	(17,024)	[4,086]	{2,043}
Monroe	11,675	11,879	12,013	12,013	12,270	(2,454)	[589]	{294}	12,556	(2,511)	[603]	{301}	12,864	(2,573)	[617]	{309}
Oakland	88,629	89,337	90,618	90,618	93,070	(18,614)	[4,467]	{2,234}	95,784	(19,157)	[4,598]	{2,299}	98,814	(19,763)	[4,743]	{2,372}
Washtenaw	21,096	21,259	21,439	21,439	21,862	(4,372)	[1,049]	{525}	22,333	(4,467)	[1,072]	{536}	22,866	(4,573)	[1,098]	{549}
Wayne	120,222	121,125	122,971	122,971	126,037	(25,207)	[6,050]	{3,025}	129,553	(25,911)	[6,219]	{3,109}	133,469	(26,694)	[6,407]	{3,203}

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.