

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 1/21/21**

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 1/21/21 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.

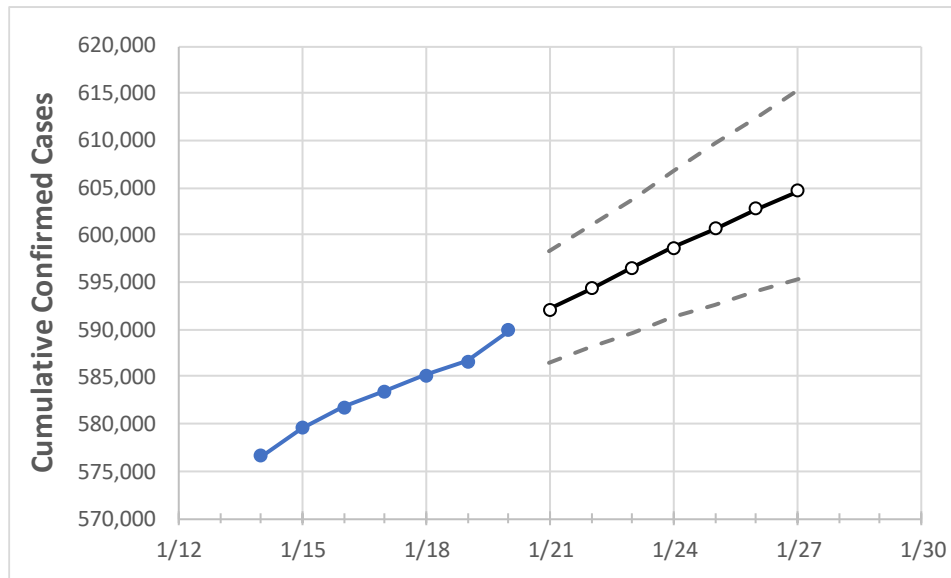
IEM's Modeling Lead

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:						
	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27
Michigan	583,457	585,128	586,673	589,869	592,153	594,367	596,523	598,628	600,671	602,736	604,703

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:						
	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27
Genesee	23,538	23,602	23,673	23,760	23,850	23,938	24,024	24,107	24,190	24,270	24,350
Ingham	14,091	14,155	14,230	14,310	14,387	14,464	14,543	14,619	14,695	14,772	14,847
Kent	47,364	47,486	47,631	47,826	47,995	48,161	48,322	48,478	48,637	48,787	48,934
Livingston	9,002	9,044	9,088	9,132	9,183	9,233	9,282	9,330	9,376	9,421	9,466
Macomb	53,550	53,699	53,878	54,111	54,294	54,472	54,647	54,820	54,992	55,160	55,320
Monroe	8,647	8,690	8,732	8,774	8,819	8,863	8,907	8,950	8,994	9,037	9,078
Oakland	67,491	67,674	67,987	68,244	68,516	68,786	69,047	69,305	69,556	69,801	70,045
Washtenaw	15,465	15,517	15,602	15,710	15,795	15,878	15,962	16,042	16,123	16,203	16,282
Wayne	92,713	92,976	93,373	93,737	94,096	94,455	94,803	95,150	95,487	95,818	96,137

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:											
	1/17	1/18	1/19	1/20	1/22				1/24				1/26			
Genesee	23,538	23,602	23,673	23,760	23,938	(4,788)	[1,149]	{575}	24,107	(4,821)	[1,157]	{579}	24,270	(4,854)	[1,165]	{582}
Ingham	14,091	14,155	14,230	14,310	14,464	(2,893)	[694]	{347}	14,619	(2,924)	[702]	{351}	14,772	(2,954)	[709]	{355}
Kent	47,364	47,486	47,631	47,826	48,161	(9,632)	[2,312]	{1,156}	48,478	(9,696)	[2,327]	{1,163}	48,787	(9,757)	[2,342]	{1,171}
Livingston	9,002	9,044	9,088	9,132	9,233	(1,847)	[443]	{222}	9,330	(1,866)	[448]	{224}	9,421	(1,884)	[452]	{226}
Macomb	53,550	53,699	53,878	54,111	54,472	(10,894)	[2,615]	{1,307}	54,820	(10,964)	[2,631]	{1,316}	55,160	(11,032)	[2,648]	{1,324}
Monroe	8,647	8,690	8,732	8,774	8,863	(1,773)	[425]	{213}	8,950	(1,790)	[430]	{215}	9,037	(1,807)	[434]	{217}
Oakland	67,491	67,674	67,987	68,244	68,786	(13,757)	[3,302]	{1,651}	69,305	(13,861)	[3,327]	{1,663}	69,801	(13,960)	[3,350]	{1,675}
Washtenaw	15,465	15,517	15,602	15,710	15,878	(3,176)	[762]	{381}	16,042	(3,208)	[770]	{385}	16,203	(3,241)	[778]	{389}
Wayne	92,713	92,976	93,373	93,737	94,455	(18,891)	[4,534]	{2,267}	95,150	(19,030)	[4,567]	{2,284}	95,818	(19,164)	[4,599]	{2,300}

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.