

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 1/20/21**

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 1/20/21 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.

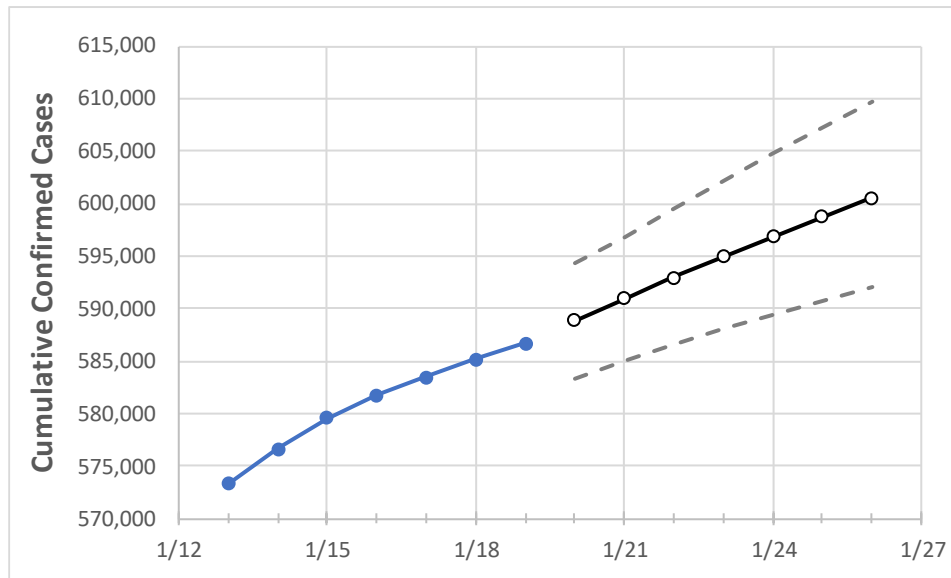
IEM's Modeling Lead

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:						
	1/16	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26
Michigan	581,785	583,457	585,128	586,673	588,878	590,958	592,988	594,952	596,861	598,763	600,573

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:						
	1/16	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26
Genesee	23,473	23,538	23,602	23,673	23,780	23,885	23,989	24,092	24,195	24,297	24,398
Ingham	14,026	14,091	14,155	14,230	14,307	14,384	14,460	14,538	14,615	14,691	14,766
Kent	47,241	47,364	47,486	47,631	47,803	47,968	48,134	48,294	48,446	48,599	48,744
Livingston	8,959	9,002	9,044	9,044	9,096	9,147	9,197	9,248	9,297	9,343	9,388
Macomb	53,400	53,550	53,699	53,878	54,053	54,226	54,394	54,557	54,720	54,875	55,021
Monroe	8,603	8,647	8,690	8,690	8,737	8,783	8,828	8,872	8,915	8,960	9,000
Oakland	67,307	67,491	67,674	67,987	68,274	68,543	68,817	69,078	69,333	69,587	69,828
Washtenaw	15,413	15,465	15,517	15,602	15,680	15,756	15,831	15,903	15,974	16,044	16,113
Wayne	92,449	92,713	92,976	93,373	93,752	94,127	94,498	94,866	95,236	95,596	95,944

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:											
	1/16	1/17	1/18	1/19	1/21				1/23				1/25			
Genesee	23,473	23,538	23,602	23,673	23,885	(4,777)	[1,146]	{573}	24,092	(4,818)	[1,156]	{578}	24,297	(4,859)	[1,166]	{583}
Ingham	14,026	14,091	14,155	14,230	14,384	(2,877)	[690]	{345}	14,538	(2,908)	[698]	{349}	14,691	(2,938)	[705]	{353}
Kent	47,241	47,364	47,486	47,631	47,968	(9,594)	[2,302]	{1,151}	48,294	(9,659)	[2,318]	{1,159}	48,599	(9,720)	[2,333]	{1,166}
Livingston	8,959	9,002	9,044	9,044	9,147	(1,829)	[439]	{220}	9,248	(1,850)	[444]	{222}	9,343	(1,869)	[448]	{224}
Macomb	53,400	53,550	53,699	53,878	54,226	(10,845)	[2,603]	{1,301}	54,557	(10,911)	[2,619]	{1,309}	54,875	(10,975)	[2,634]	{1,317}
Monroe	8,603	8,647	8,690	8,690	8,783	(1,757)	[422]	{211}	8,872	(1,774)	[426]	{213}	8,960	(1,792)	[430]	{215}
Oakland	67,307	67,491	67,674	67,987	68,543	(13,709)	[3,290]	{1,645}	69,078	(13,816)	[3,316]	{1,658}	69,587	(13,917)	[3,340]	{1,670}
Washtenaw	15,413	15,465	15,517	15,602	15,756	(3,151)	[756]	{378}	15,903	(3,181)	[763]	{382}	16,044	(3,209)	[770]	{385}
Wayne	92,449	92,713	92,976	93,373	94,127	(18,825)	[4,518]	{2,259}	94,866	(18,973)	[4,554]	{2,277}	95,596	(19,119)	[4,589]	{2,294}

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.