

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 11/5/21**

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 11/5/21 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.

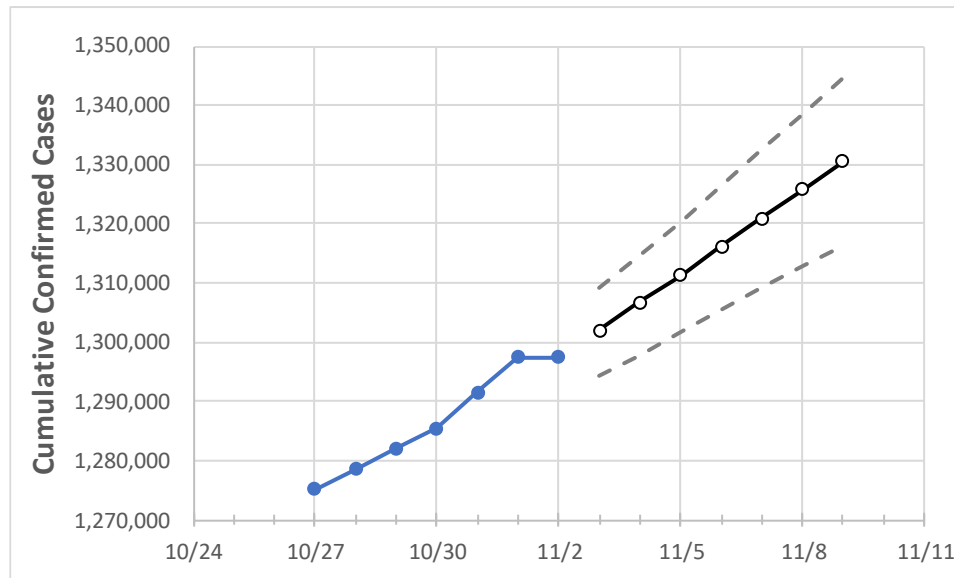
IEM's Modeling Lead

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:							
	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7	11/8	11/9	
Michigan	1,285,518	1,291,507	1,297,496	1,297,496	1,301,960	1,306,710	1,311,316	1,316,188	1,320,854	1,325,738	1,330,497	

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:							
	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7	11/8	11/9	
Genesee	53,145	53,375	53,604	53,604	53,793	53,994	54,190	54,386	54,590	54,791	54,993	
Ingham	31,521	31,689	31,857	31,857	31,977	32,099	32,224	32,355	32,483	32,614	32,749	
Kent	95,061	95,480	95,898	95,898	96,223	96,553	96,885	97,217	97,544	97,885	98,221	
Livingston	23,628	23,777	23,925	23,925	24,024	24,125	24,228	24,330	24,433	24,537	24,639	
Macomb	123,374	123,796	124,217	124,217	124,638	125,070	125,504	125,950	126,405	126,861	127,325	
Monroe	20,905	20,991	21,076	21,076	21,151	21,227	21,301	21,376	21,454	21,533	21,607	
Oakland	147,952	148,516	149,080	149,080	149,530	149,980	150,444	150,906	151,376	151,873	152,340	
Washtenaw	33,770	33,917	34,063	34,063	34,171	34,274	34,382	34,492	34,596	34,709	34,819	
Wayne	201,812	202,564	203,316	203,316	203,915	204,503	205,119	205,745	206,374	207,008	207,659	

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:											
	10/30	10/31	11/1	11/2	11/4			11/6			11/8					
Genesee	53,145	53,375	53,604	53,604	53,994	(10,799)	[2,592]	{1,296}	54,386	(10,877)	[2,611]	{1,305}	54,791	(10,958)	[2,630]	{1,315}
Ingham	31,521	31,689	31,857	31,857	32,099	(6,420)	[1,541]	{770}	32,355	(6,471)	[1,553]	{777}	32,614	(6,523)	[1,565]	{783}
Kent	95,061	95,480	95,898	95,898	96,553	(19,311)	[4,635]	{2,317}	97,217	(19,443)	[4,666]	{2,333}	97,885	(19,577)	[4,698]	{2,349}
Livingston	23,628	23,777	23,925	23,925	24,125	(4,825)	[1,158]	{579}	24,330	(4,866)	[1,168]	{584}	24,537	(4,907)	[1,178]	{589}
Macomb	123,374	123,796	124,217	124,217	125,070	(25,014)	[6,003]	{3,002}	125,950	(25,190)	[6,046]	{3,023}	126,861	(25,372)	[6,089]	{3,045}
Monroe	20,905	20,991	21,076	21,076	21,227	(4,245)	[1,019]	{509}	21,376	(4,275)	[1,026]	{513}	21,533	(4,307)	[1,034]	{517}
Oakland	147,952	148,516	149,080	149,080	149,980	(29,996)	[7,199]	{3,600}	150,906	(30,181)	[7,243]	{3,622}	151,873	(30,375)	[7,290]	{3,645}
Washtenaw	33,770	33,917	34,063	34,063	34,274	(6,855)	[1,645]	{823}	34,492	(6,898)	[1,656]	{828}	34,709	(6,942)	[1,666]	{833}
Wayne	201,812	202,564	203,316	203,316	204,503	(40,901)	[9,816]	{4,908}	205,745	(41,149)	[9,876]	{4,938}	207,008	(41,402)	[9,936]	{4,968}

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.