

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

Date: 10/29/21

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 10/29/21 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.

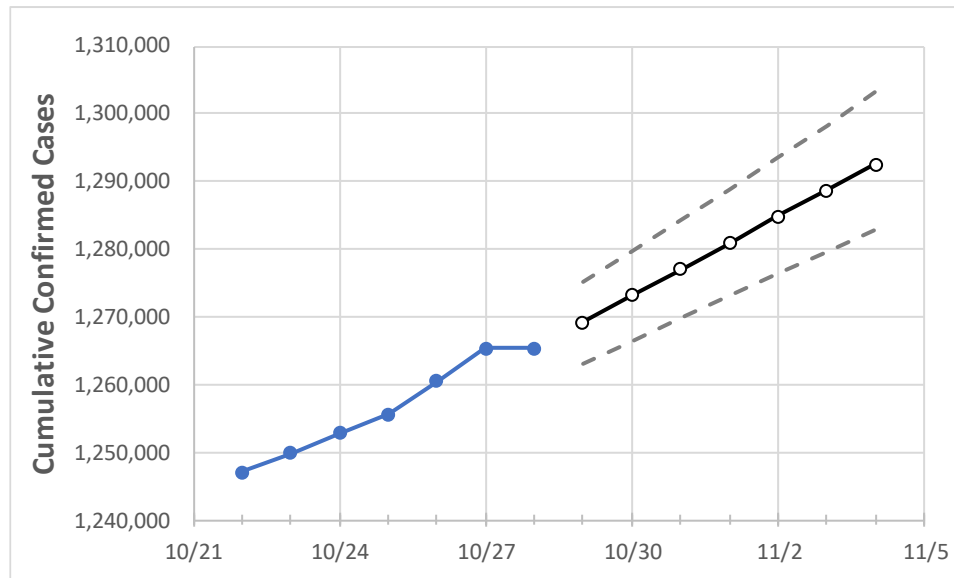
IEM's Modeling Lead

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:						
	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1	11/2	11/3	11/4
Michigan	1,255,595	1,260,488	1,265,381	1,265,381	1,269,254	1,273,142	1,276,965	1,280,871	1,284,807	1,288,655	1,292,525

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:						
	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1	11/2	11/3	11/4
Genesee	51,842	52,004	52,166	52,166	52,344	52,523	52,700	52,883	53,057	53,241	53,423
Ingham	30,797	30,920	31,042	31,042	31,126	31,213	31,294	31,380	31,465	31,553	31,634
Kent	92,913	93,237	93,560	93,560	93,863	94,167	94,464	94,771	95,072	95,380	95,686
Livingston	22,946	23,062	23,177	23,177	23,265	23,352	23,439	23,524	23,611	23,694	23,777
Macomb	120,771	121,148	121,524	121,524	121,847	122,173	122,499	122,824	123,149	123,478	123,806
Monroe	20,312	20,417	20,521	20,521	20,592	20,665	20,736	20,809	20,878	20,948	21,018
Oakland	145,119	145,583	146,046	146,046	146,411	146,782	147,152	147,522	147,897	148,281	148,656
Washtenaw	33,130	33,226	33,322	33,322	33,401	33,480	33,557	33,635	33,711	33,789	33,863
Wayne	198,198	198,796	199,394	199,394	199,885	200,358	200,850	201,342	201,837	202,319	202,820

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:											
	10/25	10/26	10/27	10/28	10/30			11/1			11/3					
Genesee	51,842	52,004	52,166	52,166	52,523	(10,505)	[2,521]	{1,261}	52,883	(10,577)	[2,538]	{1,269}	53,241	(10,648)	[2,556]	{1,278}
Ingham	30,797	30,920	31,042	31,042	31,213	(6,243)	[1,498]	{749}	31,380	(6,276)	[1,506]	{753}	31,553	(6,311)	[1,515]	{757}
Kent	92,913	93,237	93,560	93,560	94,167	(18,833)	[4,520]	{2,260}	94,771	(18,954)	[4,549]	{2,274}	95,380	(19,076)	[4,578]	{2,289}
Livingston	22,946	23,062	23,177	23,177	23,352	(4,670)	[1,121]	{560}	23,524	(4,705)	[1,129]	{565}	23,694	(4,739)	[1,137]	{569}
Macomb	120,771	121,148	121,524	121,524	122,173	(24,435)	[5,864]	{2,932}	122,824	(24,565)	[5,896]	{2,948}	123,478	(24,696)	[5,927]	{2,963}
Monroe	20,312	20,417	20,521	20,521	20,665	(4,133)	[992]	{496}	20,809	(4,162)	[999]	{499}	20,948	(4,190)	[1,006]	{503}
Oakland	145,119	145,583	146,046	146,046	146,782	(29,356)	[7,046]	{3,523}	147,522	(29,504)	[7,081]	{3,541}	148,281	(29,656)	[7,117]	{3,559}
Washtenaw	33,130	33,226	33,322	33,322	33,480	(6,696)	[1,607]	{804}	33,635	(6,727)	[1,614]	{807}	33,789	(6,758)	[1,622]	{811}
Wayne	198,198	198,796	199,394	199,394	200,358	(40,072)	[9,617]	{4,809}	201,342	(40,268)	[9,664]	{4,832}	202,319	(40,464)	[9,711]	{4,856}

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.