

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 12/3/21**

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 12/3/21 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.

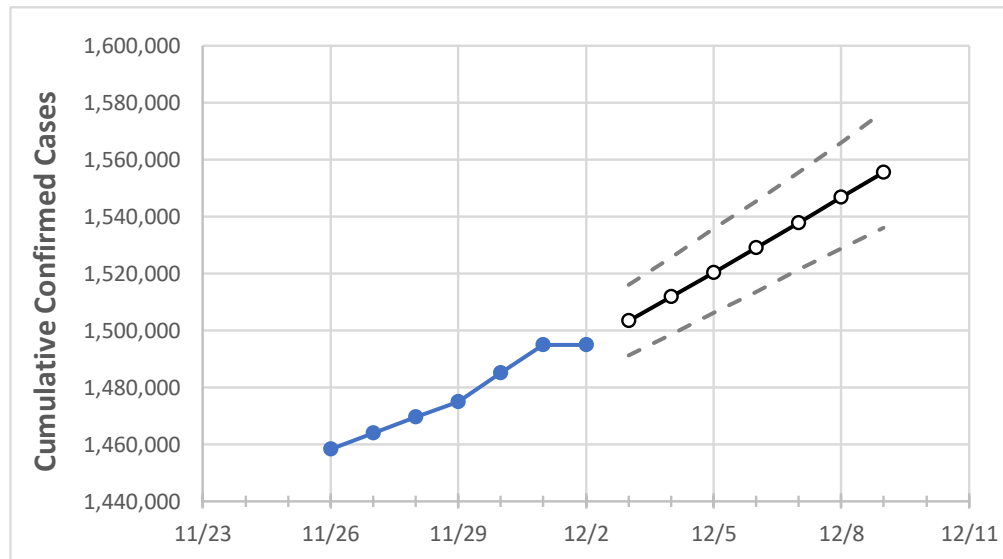
IEM's Modeling Lead

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:						
	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7	12/8	12/9
Michigan	1,475,053	1,485,003	1,494,953	1,494,953	1,503,274	1,511,792	1,520,415	1,528,967	1,537,791	1,546,750	1,555,502

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:						
	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7	12/8	12/9
Genesee	61,265	61,702	62,139	62,139	62,525	62,924	63,323	63,727	64,144	64,556	64,988
Ingham	36,468	36,701	36,933	36,933	37,126	37,320	37,515	37,707	37,905	38,100	38,299
Kent	109,350	110,003	110,656	110,656	111,275	111,879	112,463	113,067	113,681	114,299	114,908
Livingston	28,458	28,722	28,985	28,985	29,189	29,403	29,609	29,818	30,038	30,254	30,465
Macomb	140,170	141,075	141,980	141,980	142,800	143,631	144,461	145,306	146,163	147,035	147,919
Monroe	23,764	23,904	24,044	24,044	24,150	24,257	24,366	24,469	24,576	24,684	24,792
Oakland	168,182	169,354	170,525	170,525	171,546	172,541	173,585	174,651	175,747	176,834	177,915
Washtenaw	38,566	38,838	39,110	39,110	39,333	39,560	39,782	40,016	40,247	40,487	40,724
Wayne	228,228	229,713	231,197	231,197	232,524	233,896	235,266	236,677	238,089	239,509	240,986

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:											
	11/29	11/30	12/1	12/2	12/4				12/6				12/8			
Genesee	61,265	61,702	62,139	62,139	62,924	(12,585)	[3,020]	{1,510}	63,727	(12,745)	[3,059]	{1,529}	64,556	(12,911)	[3,099]	{1,549}
Ingham	36,468	36,701	36,933	36,933	37,320	(7,464)	[1,791]	{896}	37,707	(7,541)	[1,810]	{905}	38,100	(7,620)	[1,829]	{914}
Kent	109,350	110,003	110,656	110,656	111,879	(22,376)	[5,370]	{2,685}	113,067	(22,613)	[5,427]	{2,714}	114,299	(22,860)	[5,486]	{2,743}
Livingston	28,458	28,722	28,985	28,985	29,403	(5,881)	[1,411]	{706}	29,818	(5,964)	[1,431]	{716}	30,254	(6,051)	[1,452]	{726}
Macomb	140,170	141,075	141,980	141,980	143,631	(28,726)	[6,894]	{3,447}	145,306	(29,061)	[6,975]	{3,487}	147,035	(29,407)	[7,058]	{3,529}
Monroe	23,764	23,904	24,044	24,044	24,257	(4,851)	[1,164]	{582}	24,469	(4,894)	[1,175]	{587}	24,684	(4,937)	[1,185]	{592}
Oakland	168,182	169,354	170,525	170,525	172,541	(34,508)	[8,282]	{4,141}	174,651	(34,930)	[8,383]	{4,192}	176,834	(35,367)	[8,488]	{4,244}
Washtenaw	38,566	38,838	39,110	39,110	39,560	(7,912)	[1,899]	{949}	40,016	(8,003)	[1,921]	{960}	40,487	(8,097)	[1,943]	{972}
Wayne	228,228	229,713	231,197	231,197	233,896	(46,779)	[11,227]	{5,614}	236,677	(47,335)	[11,360]	{5,680}	239,509	(47,902)	[11,496]	{5,748}

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.