

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

Date: 11/1/21

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 11/1/21 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.

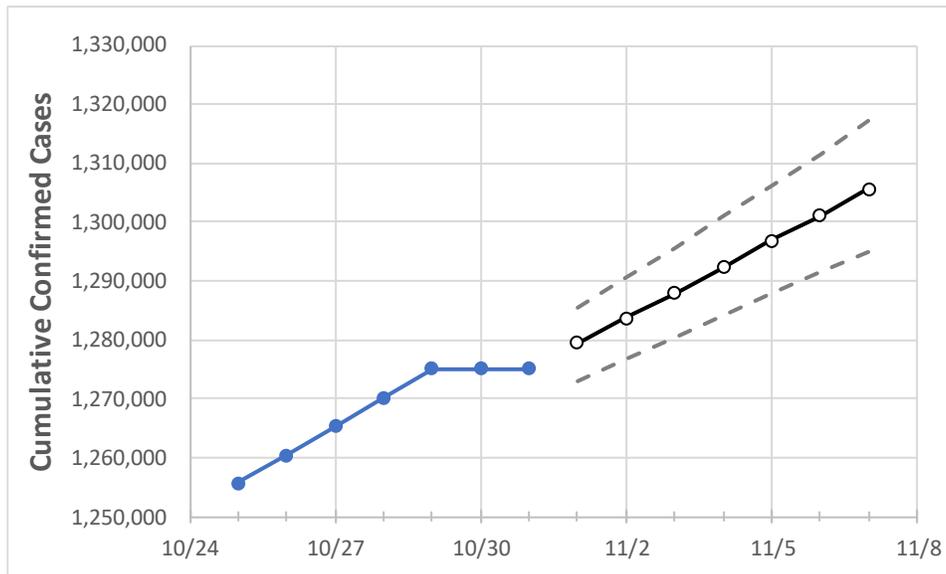
IEM's Modeling Lead

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:							
	10/28	10/29	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7	
Michigan	1,270,242	1,275,103	1,275,103	1,275,103	1,279,454	1,283,757	1,287,975	1,292,367	1,296,808	1,301,156	1,305,602	

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:							
	10/28	10/29	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7	
Genesee	52,409	52,652	52,652	52,652	52,850	53,048	53,246	53,447	53,653	53,862	54,060	
Ingham	31,169	31,296	31,296	31,296	31,395	31,491	31,592	31,692	31,797	31,898	32,001	
Kent	93,943	94,325	94,325	94,325	94,662	94,989	95,330	95,665	96,012	96,353	96,697	
Livingston	23,289	23,401	23,401	23,401	23,497	23,591	23,685	23,780	23,874	23,971	24,066	
Macomb	121,889	122,253	122,253	122,253	122,605	122,963	123,319	123,683	124,054	124,424	124,796	
Monroe	20,634	20,747	20,747	20,747	20,833	20,918	21,003	21,089	21,176	21,263	21,348	
Oakland	146,495	146,943	146,943	146,943	147,344	147,752	148,160	148,580	148,994	149,421	149,840	
Washtenaw	33,426	33,529	33,529	33,529	33,616	33,704	33,788	33,878	33,963	34,052	34,138	
Wayne	199,942	200,490	200,490	200,490	201,010	201,535	202,064	202,605	203,143	203,683	204,230	

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:											
	10/28	10/29	10/30	10/31	11/2			11/4			11/6					
Genesee	52,409	52,652	52,652	52,652	53,048	(10,610)	[2,546]	{1,273}	53,447	(10,689)	[2,565]	{1,283}	53,862	(10,772)	[2,585]	{1,293}
Ingham	31,169	31,296	31,296	31,296	31,491	(6,298)	[1,512]	{756}	31,692	(6,338)	[1,521]	{761}	31,898	(6,380)	[1,531]	{766}
Kent	93,943	94,325	94,325	94,325	94,989	(18,998)	[4,559]	{2,280}	95,665	(19,133)	[4,592]	{2,296}	96,353	(19,271)	[4,625]	{2,312}
Livingston	23,289	23,401	23,401	23,401	23,591	(4,718)	[1,132]	{566}	23,780	(4,756)	[1,141]	{571}	23,971	(4,794)	[1,151]	{575}
Macomb	121,889	122,253	122,253	122,253	122,963	(24,593)	[5,902]	{2,951}	123,683	(24,737)	[5,937]	{2,968}	124,424	(24,885)	[5,972]	{2,986}
Monroe	20,634	20,747	20,747	20,747	20,918	(4,184)	[1,004]	{502}	21,089	(4,218)	[1,012]	{506}	21,263	(4,253)	[1,021]	{510}
Oakland	146,495	146,943	146,943	146,943	147,752	(29,550)	[7,092]	{3,546}	148,580	(29,716)	[7,132]	{3,566}	149,421	(29,884)	[7,172]	{3,586}
Washtenaw	33,426	33,529	33,529	33,529	33,704	(6,741)	[1,618]	{809}	33,878	(6,776)	[1,626]	{813}	34,052	(6,810)	[1,634]	{817}
Wayne	199,942	200,490	200,490	200,490	201,535	(40,307)	[9,674]	{4,837}	202,605	(40,521)	[9,725]	{4,863}	203,683	(40,737)	[9,777]	{4,888}

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.