

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

Date: 11/8/21

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 11/8/21 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.

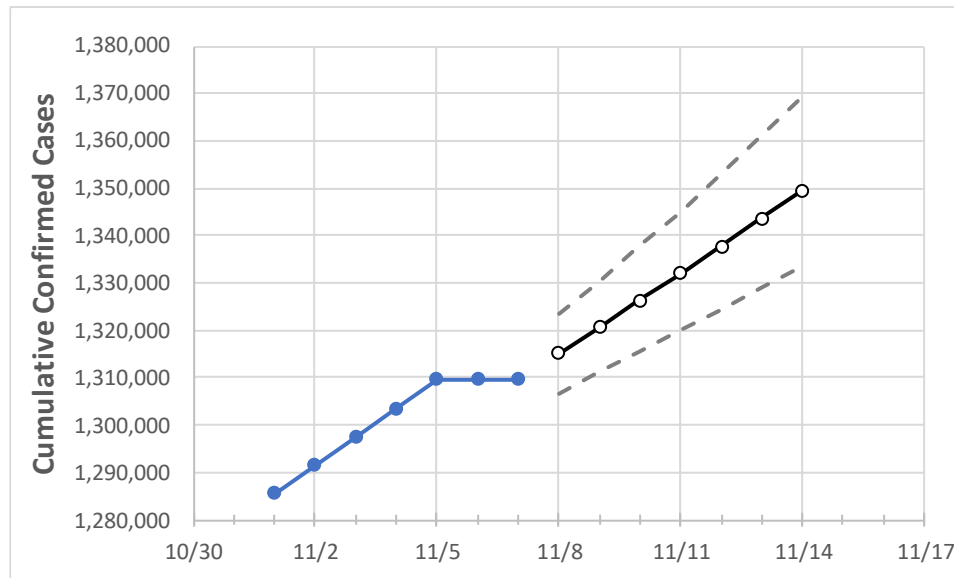
IEM's Modeling Lead

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:						
	11/4	11/5	11/6	11/7	11/8	11/9	11/10	11/11	11/12	11/13	11/14
Michigan	1,303,576	1,309,655	1,309,655	1,309,655	1,315,110	1,320,640	1,326,332	1,332,035	1,337,722	1,343,686	1,349,618

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:							
	11/4	11/5	11/6	11/7	11/8	11/9	11/10	11/11	11/12	11/13	11/14	
Genesee	53,843	54,081	54,081	54,081	54,294	54,517	54,733	54,955	55,178	55,404	55,630	
Ingham	32,010	32,163	32,163	32,163	32,303	32,447	32,595	32,748	32,902	33,060	33,223	
Kent	96,330	96,762	96,762	96,762	97,131	97,505	97,878	98,259	98,650	99,036	99,428	
Livingston	24,091	24,257	24,257	24,257	24,381	24,508	24,633	24,761	24,887	25,021	25,155	
Macomb	124,715	125,213	125,213	125,213	125,747	126,306	126,886	127,479	128,090	128,718	129,360	
Monroe	21,187	21,297	21,297	21,297	21,385	21,469	21,555	21,641	21,731	21,819	21,908	
Oakland	149,721	150,362	150,362	150,362	150,916	151,484	152,055	152,658	153,255	153,888	154,514	
Washtenaw	34,231	34,398	34,398	34,398	34,560	34,736	34,915	35,109	35,305	35,505	35,717	
Wayne	204,090	204,864	204,864	204,864	205,578	206,311	207,045	207,785	208,573	209,376	210,159	

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:											
	11/4	11/5	11/6	11/7	11/9			11/11			11/13					
Genesee	53,843	54,081	54,081	54,081	54,517	(10,903)	[2,617]	{1,308}	54,955	(10,991)	[2,638]	{1,319}	55,404	(11,081)	[2,659]	{1,330}
Ingham	32,010	32,163	32,163	32,163	32,447	(6,489)	[1,557]	{779}	32,748	(6,550)	[1,572]	{786}	33,060	(6,612)	[1,587]	{793}
Kent	96,330	96,762	96,762	96,762	97,505	(19,501)	[4,680]	{2,340}	98,259	(19,652)	[4,716]	{2,358}	99,036	(19,807)	[4,754]	{2,377}
Livingston	24,091	24,257	24,257	24,257	24,508	(4,902)	[1,176]	{588}	24,761	(4,952)	[1,189]	{594}	25,021	(5,004)	[1,201]	{601}
Macomb	124,715	125,213	125,213	125,213	126,306	(25,261)	[6,063]	{3,031}	127,479	(25,496)	[6,119]	{3,059}	128,718	(25,744)	[6,178]	{3,089}
Monroe	21,187	21,297	21,297	21,297	21,469	(4,294)	[1,031]	{515}	21,641	(4,328)	[1,039]	{519}	21,819	(4,364)	[1,047]	{524}
Oakland	149,721	150,362	150,362	150,362	151,484	(30,297)	[7,271]	{3,636}	152,658	(30,532)	[7,328]	{3,664}	153,888	(30,778)	[7,387]	{3,693}
Washtenaw	34,231	34,398	34,398	34,398	34,736	(6,947)	[1,667]	{834}	35,109	(7,022)	[1,685]	{843}	35,505	(7,101)	[1,704]	{852}
Wayne	204,090	204,864	204,864	204,864	206,311	(41,262)	[9,903]	{4,951}	207,785	(41,557)	[9,974]	{4,987}	209,376	(41,875)	[10,050]	{5,025}

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.