

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 11/10/21**

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 11/10/21 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.

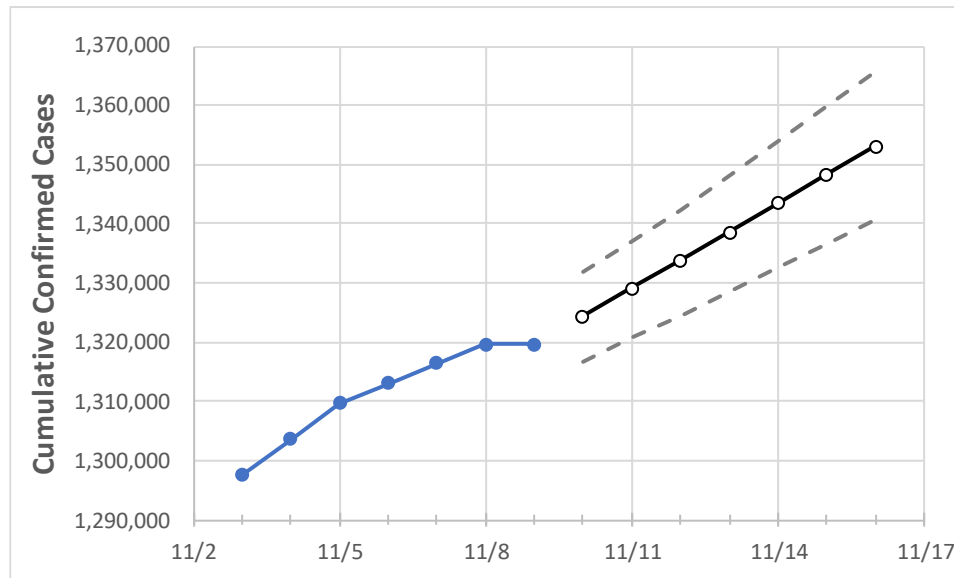
IEM's Modeling Lead

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:						
	11/6	11/7	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15	11/16	
Michigan	1,313,011	1,316,368	1,319,724	1,319,724	1,324,364	1,329,153	1,333,853	1,338,555	1,343,388	1,348,388	1,353,128	

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:							
	11/6	11/7	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15	11/16	
Genesee	54,238	54,395	54,552	54,552	54,748	54,943	55,136	55,334	55,533	55,734	55,928	
Ingham	32,264	32,366	32,467	32,467	32,598	32,735	32,872	33,013	33,157	33,299	33,449	
Kent	96,993	97,225	97,456	97,456	97,777	98,093	98,414	98,737	99,065	99,386	99,709	
Livingston	24,351	24,446	24,540	24,540	24,655	24,770	24,890	25,008	25,126	25,247	25,366	
Macomb	125,466	125,719	125,972	125,972	126,347	126,739	127,117	127,501	127,889	128,289	128,686	
Monroe	21,361	21,426	21,490	21,490	21,569	21,650	21,729	21,808	21,887	21,969	22,047	
Oakland	150,658	150,955	151,251	151,251	151,712	152,166	152,636	153,109	153,581	154,068	154,555	
Washtenaw	34,492	34,587	34,681	34,681	34,802	34,922	35,045	35,168	35,295	35,424	35,552	
Wayne	205,301	205,739	206,176	206,176	206,767	207,376	207,993	208,591	209,221	209,874	210,492	

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:											
	11/6	11/7	11/8	11/9	11/11			11/13			11/15					
Genesee	54,238	54,395	54,552	54,552	54,943	(10,989)	[2,637]	{1,319}	55,334	(11,067)	[2,656]	{1,328}	55,734	(11,147)	[2,675]	{1,338}
Ingham	32,264	32,366	32,467	32,467	32,735	(6,547)	[1,571]	{786}	33,013	(6,603)	[1,585]	{792}	33,299	(6,660)	[1,598]	{799}
Kent	96,993	97,225	97,456	97,456	98,093	(19,619)	[4,708]	{2,354}	98,737	(19,747)	[4,739]	{2,370}	99,386	(19,877)	[4,771]	{2,385}
Livingston	24,351	24,446	24,540	24,540	24,770	(4,954)	[1,189]	{594}	25,008	(5,002)	[1,200]	{600}	25,247	(5,049)	[1,212]	{606}
Macomb	125,466	125,719	125,972	125,972	126,739	(25,348)	[6,083]	{3,042}	127,501	(25,500)	[6,120]	{3,060}	128,289	(25,658)	[6,158]	{3,079}
Monroe	21,361	21,426	21,490	21,490	21,650	(4,330)	[1,039]	{520}	21,808	(4,362)	[1,047]	{523}	21,969	(4,394)	[1,055]	{527}
Oakland	150,658	150,955	151,251	151,251	152,166	(30,433)	[7,304]	{3,652}	153,109	(30,622)	[7,349]	{3,675}	154,068	(30,814)	[7,395]	{3,698}
Washtenaw	34,492	34,587	34,681	34,681	34,922	(6,984)	[1,676]	{838}	35,168	(7,034)	[1,688]	{844}	35,424	(7,085)	[1,700]	{850}
Wayne	205,301	205,739	206,176	206,176	207,376	(41,475)	[9,954]	{4,977}	208,591	(41,718)	[10,012]	{5,006}	209,874	(41,975)	[10,074]	{5,037}

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.