

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 11/18/20**

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 11/18/20 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.

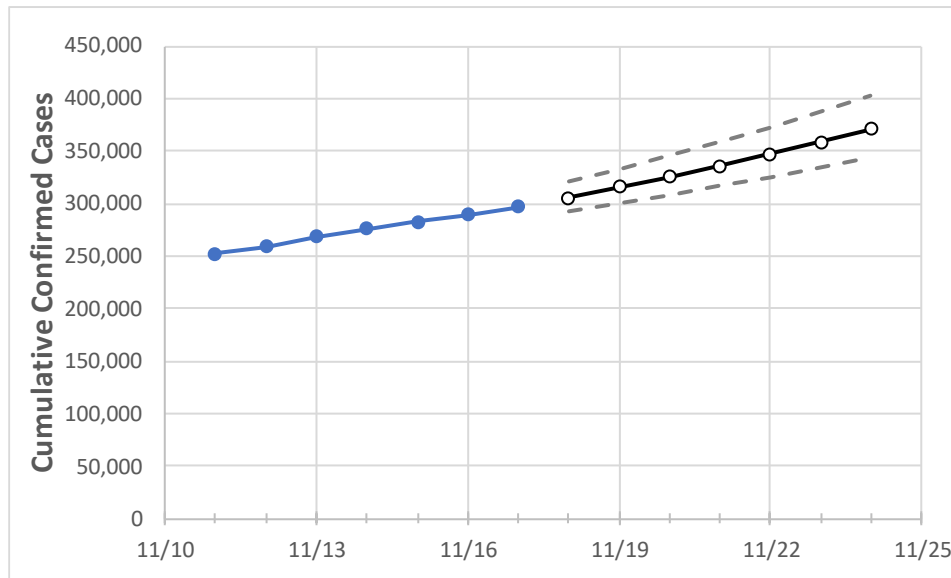
IEM's Modeling Lead

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:					
	11/14	11/15	11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23	11/24
Michigan	275,792	282,373	288,954	296,840	305,887	315,397	325,393	335,899	346,938	358,536	370,720

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 20%, and are often within 10%, of actual confirmed cases.

Michigan Counties

	Actual Confirmed Cases On:					Projected Cases For:					
	11/14	11/15	11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23	11/24
Genesee	10,245	10,511	10,777	11,179	11,523	11,885	12,267	12,670	13,095	13,543	14,015
Ingham	6,578	6,747	6,916	7,038	7,217	7,407	7,609	7,824	8,053	8,296	8,555
Kent	23,625	24,308	24,990	25,699	26,574	27,493	28,458	29,470	30,533	31,648	32,818
Livingston	3,549	3,663	3,776	3,924	4,067	4,218	4,376	4,542	4,716	4,899	5,091
Macomb	27,199	27,729	28,258	29,063	29,945	30,878	31,863	32,906	34,007	35,171	36,400
Monroe	3,452	3,532	3,612	3,754	3,908	4,073	4,249	4,437	4,637	4,850	5,078
Oakland	34,658	35,339	36,020	36,983	37,935	38,941	40,003	41,123	42,306	43,554	44,871
Washtenaw	7,512	7,644	7,775	7,935	8,095	8,259	8,429	8,605	8,786	8,972	9,165
Wayne	50,486	51,221	51,956	52,958	53,935	54,963	56,044	57,181	58,376	59,633	60,955

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:											
	11/14	11/15	11/16	11/17	11/19				11/21				11/23			
Genesee	10,245	10,511	10,777	11,179	11,885	(2,377)	[570]	{285}	12,670	(2,534)	[608]	{304}	13,543	(2,709)	[650]	{325}
Ingham	6,578	6,747	6,916	7,038	7,407	(1,481)	[356]	{178}	7,824	(1,565)	[376]	{188}	8,296	(1,659)	[398]	{199}
Kent	23,625	24,308	24,990	25,699	27,493	(5,499)	[1,320]	{660}	29,470	(5,894)	[1,415]	{707}	31,648	(6,330)	[1,519]	{760}
Livingston	3,549	3,663	3,776	3,924	4,218	(844)	[202]	{101}	4,542	(908)	[218]	{109}	4,899	(980)	[235]	{118}
Macomb	27,199	27,729	28,258	29,063	30,878	(6,176)	[1,482]	{741}	32,906	(6,581)	[1,579]	{790}	35,171	(7,034)	[1,688]	{844}
Monroe	3,452	3,532	3,612	3,754	4,073	(815)	[196]	{98}	4,437	(887)	[213]	{106}	4,850	(970)	[233]	{116}
Oakland	34,658	35,339	36,020	36,983	38,941	(7,788)	[1,869]	{935}	41,123	(8,225)	[1,974]	{987}	43,554	(8,711)	[2,091]	{1,045}
Washtenaw	7,512	7,644	7,775	7,935	8,259	(1,652)	[396]	{198}	8,605	(1,721)	[413]	{207}	8,972	(1,794)	[431]	{215}
Wayne	50,486	51,221	51,956	52,958	54,963	(10,993)	[2,638]	{1,319}	57,181	(11,436)	[2,745]	{1,372}	59,633	(11,927)	[2,862]	{1,431}

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.