

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

Date: 12/18/20

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 12/18/20 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.

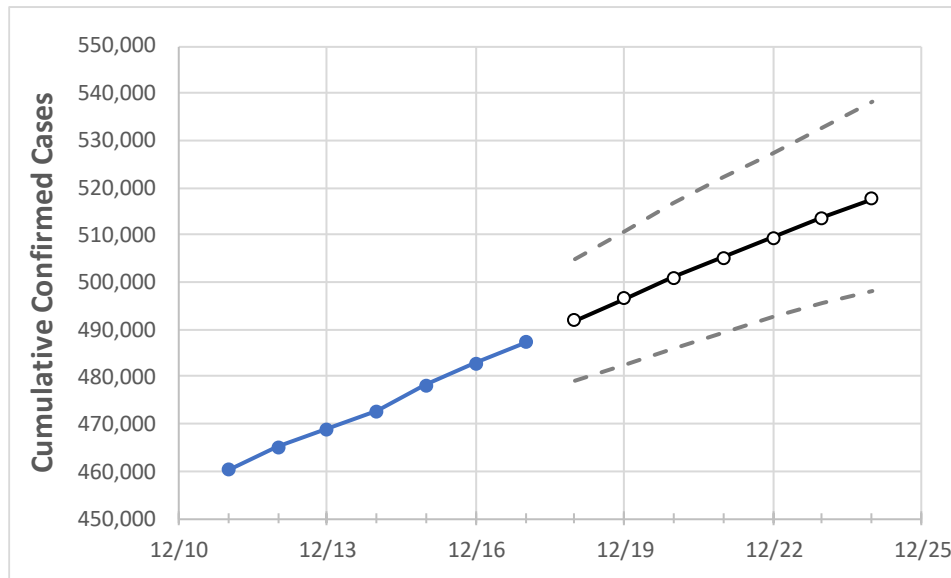
IEM's Modeling Lead

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:						
	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23	12/24
Michigan	472,780	478,171	482,815	487,356	491,989	496,521	500,952	505,287	509,526	513,671	517,725

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:						
	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23	12/24
Genesee	18,933	19,205	19,452	19,731	19,979	20,224	20,466	20,707	20,944	21,179	21,412
Ingham	11,097	11,225	11,362	11,488	11,609	11,728	11,846	11,962	12,077	12,190	12,302
Kent	39,591	39,882	40,253	40,571	40,885	41,190	41,486	41,774	42,053	42,325	42,589
Livingston	7,030	7,150	7,200	7,262	7,332	7,399	7,466	7,530	7,593	7,654	7,713
Macomb	45,245	45,847	46,225	46,561	46,960	47,350	47,730	48,101	48,464	48,817	49,162
Monroe	6,787	6,867	6,924	6,984	7,057	7,127	7,196	7,263	7,328	7,391	7,453
Oakland	55,183	55,885	56,343	56,825	57,298	57,762	58,215	58,659	59,094	59,520	59,936
Washtenaw	12,151	12,372	12,501	12,620	12,756	12,893	13,029	13,164	13,300	13,435	13,569
Wayne	76,765	77,742	78,331	78,997	79,715	80,423	81,121	81,809	82,489	83,159	83,819

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:											
	12/14	12/15	12/16	12/17	12/19				12/21				12/23			
Genesee	18,933	19,205	19,452	19,731	20,224	(4,045)	[971]	{485}	20,707	(4,141)	[994]	{497}	21,179	(4,236)	[1,017]	{508}
Ingham	11,097	11,225	11,362	11,488	11,728	(2,346)	[563]	{281}	11,962	(2,392)	[574]	{287}	12,190	(2,438)	[585]	{293}
Kent	39,591	39,882	40,253	40,571	41,190	(8,238)	[1,977]	{989}	41,774	(8,355)	[2,005]	{1,003}	42,325	(8,465)	[2,032]	{1,016}
Livingston	7,030	7,150	7,200	7,262	7,399	(1,480)	[355]	{178}	7,530	(1,506)	[361]	{181}	7,654	(1,531)	[367]	{184}
Macomb	45,245	45,847	46,225	46,561	47,350	(9,470)	[2,273]	{1,136}	48,101	(9,620)	[2,309]	{1,154}	48,817	(9,763)	[2,343]	{1,172}
Monroe	6,787	6,867	6,924	6,984	7,127	(1,425)	[342]	{171}	7,263	(1,453)	[349]	{174}	7,391	(1,478)	[355]	{177}
Oakland	55,183	55,885	56,343	56,825	57,762	(11,552)	[2,773]	{1,386}	58,659	(11,732)	[2,816]	{1,408}	59,520	(11,904)	[2,857]	{1,428}
Washtenaw	12,151	12,372	12,501	12,620	12,893	(2,579)	[619]	{309}	13,164	(2,633)	[632]	{316}	13,435	(2,687)	[645]	{322}
Wayne	76,765	77,742	78,331	78,997	80,423	(16,085)	[3,860]	{1,930}	81,809	(16,362)	[3,927]	{1,963}	83,159	(16,632)	[3,992]	{1,996}

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.