

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

Date: 12/17/20

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 12/17/20 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.

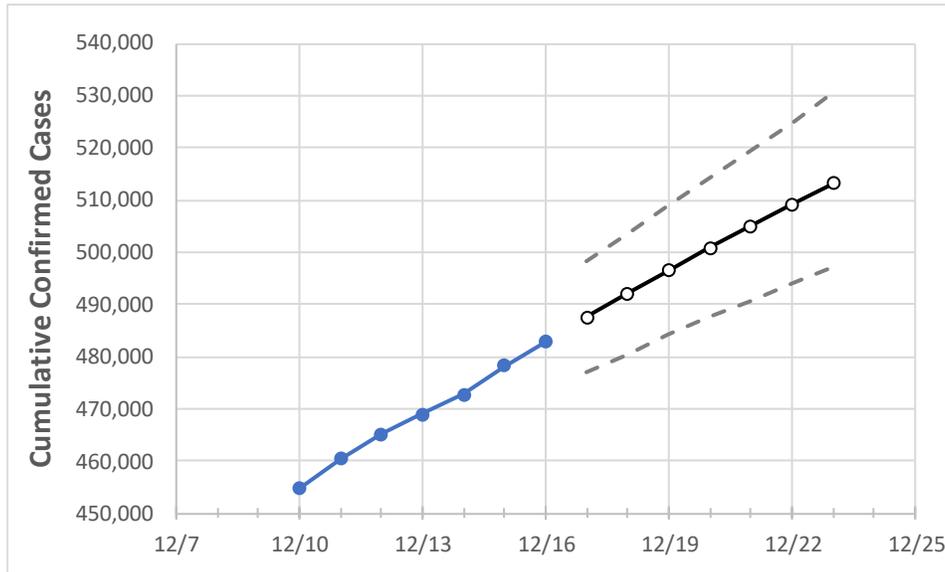
IEM's Modeling Lead

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:						
	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23
Michigan	468,970	472,780	478,171	482,815	487,509	492,078	496,525	500,854	505,068	509,170	513,164

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:						
	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23
Genesee	18,708	18,933	19,205	19,452	19,699	19,943	20,185	20,424	20,660	20,893	21,123
Ingham	11,009	11,097	11,225	11,362	11,485	11,607	11,727	11,846	11,963	12,079	12,194
Kent	39,312	39,591	39,882	40,253	40,578	40,894	41,201	41,499	41,788	42,070	42,343
Livingston	6,988	7,030	7,150	7,200	7,273	7,343	7,412	7,479	7,544	7,607	7,668
Macomb	44,953	45,245	45,847	46,225	46,643	47,050	47,448	47,837	48,217	48,588	48,950
Monroe	6,716	6,787	6,867	6,924	7,000	7,074	7,146	7,217	7,286	7,354	7,420
Oakland	54,840	55,183	55,885	56,343	56,819	57,285	57,741	58,187	58,623	59,049	59,466
Washtenaw	12,036	12,151	12,372	12,501	12,638	12,774	12,910	13,046	13,182	13,317	13,452
Wayne	76,282	76,765	77,742	78,331	79,061	79,782	80,494	81,196	81,888	82,572	83,246

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:											
	12/13	12/14	12/15	12/16	12/18				12/20				12/22			
Genesee	18,708	18,933	19,205	19,452	19,943	(3,989)	[957]	{479}	20,424	(4,085)	[980]	{490}	20,893	(4,179)	[1,003]	{501}
Ingham	11,009	11,097	11,225	11,362	11,607	(2,321)	[557]	{279}	11,846	(2,369)	[569]	{284}	12,079	(2,416)	[580]	{290}
Kent	39,312	39,591	39,882	40,253	40,894	(8,179)	[1,963]	{981}	41,499	(8,300)	[1,992]	{996}	42,070	(8,414)	[2,019]	{1,010}
Livingston	6,988	7,030	7,150	7,200	7,343	(1,469)	[352]	{176}	7,479	(1,496)	[359]	{179}	7,607	(1,521)	[365]	{183}
Macomb	44,953	45,245	45,847	46,225	47,050	(9,410)	[2,258]	{1,129}	47,837	(9,567)	[2,296]	{1,148}	48,588	(9,718)	[2,332]	{1,166}
Monroe	6,716	6,787	6,867	6,924	7,074	(1,415)	[340]	{170}	7,217	(1,443)	[346]	{173}	7,354	(1,471)	[353]	{176}
Oakland	54,840	55,183	55,885	56,343	57,285	(11,457)	[2,750]	{1,375}	58,187	(11,637)	[2,793]	{1,396}	59,049	(11,810)	[2,834]	{1,417}
Washtenaw	12,036	12,151	12,372	12,501	12,774	(2,555)	[613]	{307}	13,046	(2,609)	[626]	{313}	13,317	(2,663)	[639]	{320}
Wayne	76,282	76,765	77,742	78,331	79,782	(15,956)	[3,830]	{1,915}	81,196	(16,239)	[3,897]	{1,949}	82,572	(16,514)	[3,963]	{1,982}

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.