

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

Date: 3/5/21

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 3/5/21 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.

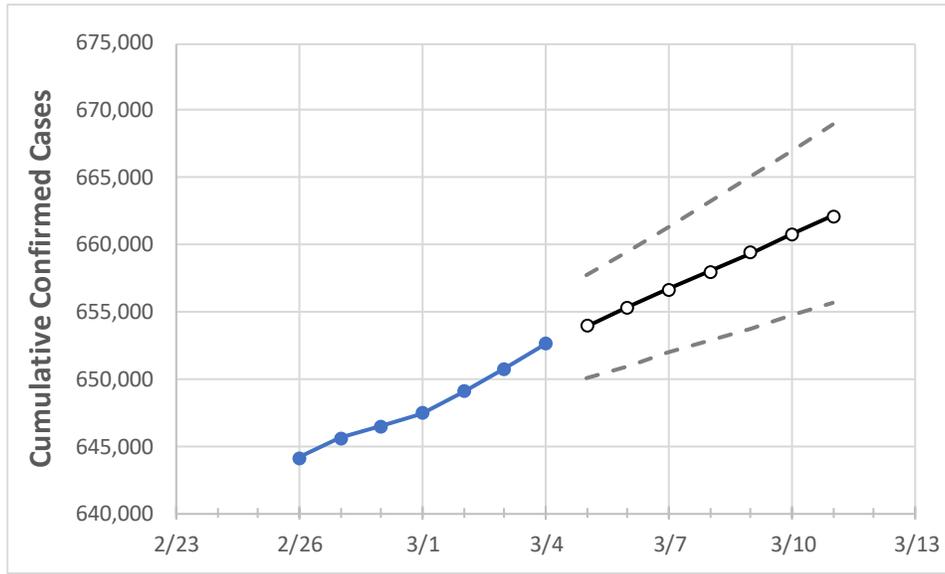
IEM's Modeling Lead

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:							
	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11	
Michigan	647,415	649,057	650,762	652,589	653,951	655,312	656,659	658,005	659,380	660,768	662,159	

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:							
	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11	
Genesee	25,656	25,753	25,834	25,937	26,023	26,111	26,204	26,301	26,403	26,507	26,619	
Ingham	16,439	16,482	16,543	16,574	16,610	16,645	16,680	16,715	16,749	16,783	16,818	
Kent	51,846	51,949	52,039	52,141	52,218	52,298	52,378	52,456	52,537	52,614	52,690	
Livingston	10,336	10,369	10,420	10,463	10,493	10,524	10,555	10,587	10,619	10,652	10,686	
Macomb	59,119	59,289	59,489	59,732	59,889	60,049	60,216	60,384	60,556	60,739	60,922	
Monroe	9,806	9,854	9,901	9,928	9,956	9,985	10,015	10,045	10,077	10,109	10,142	
Oakland	74,973	75,147	75,328	75,487	75,633	75,779	75,927	76,077	76,227	76,375	76,525	
Washtenaw	18,748	18,776	18,834	18,871	18,912	18,951	18,990	19,028	19,065	19,100	19,134	
Wayne	102,122	102,411	102,694	102,963	103,200	103,448	103,697	103,955	104,218	104,486	104,763	

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:											
	3/1	3/2	3/3	3/4	3/6			3/8			3/10					
Genesee	25,656	25,753	25,834	25,937	26,111	(5,222)	[1,253]	{627}	26,301	(5,260)	[1,262]	{631}	26,507	(5,301)	[1,272]	{636}
Ingham	16,439	16,482	16,543	16,574	16,645	(3,329)	[799]	{399}	16,715	(3,343)	[802]	{401}	16,783	(3,357)	[806]	{403}
Kent	51,846	51,949	52,039	52,141	52,298	(10,460)	[2,510]	{1,255}	52,456	(10,491)	[2,518]	{1,259}	52,614	(10,523)	[2,525]	{1,263}
Livingston	10,336	10,369	10,420	10,463	10,524	(2,105)	[505]	{253}	10,587	(2,117)	[508]	{254}	10,652	(2,130)	[511]	{256}
Macomb	59,119	59,289	59,489	59,732	60,049	(12,010)	[2,882]	{1,441}	60,384	(12,077)	[2,898]	{1,449}	60,739	(12,148)	[2,915]	{1,458}
Monroe	9,806	9,854	9,901	9,928	9,985	(1,997)	[479]	{240}	10,045	(2,009)	[482]	{241}	10,109	(2,022)	[485]	{243}
Oakland	74,973	75,147	75,328	75,487	75,779	(15,156)	[3,637]	{1,819}	76,077	(15,215)	[3,652]	{1,826}	76,375	(15,275)	[3,666]	{1,833}
Washtenaw	18,748	18,776	18,834	18,871	18,951	(3,790)	[910]	{455}	19,028	(3,806)	[913]	{457}	19,100	(3,820)	[917]	{458}
Wayne	102,122	102,411	102,694	102,963	103,448	(20,690)	[4,966]	{2,483}	103,955	(20,791)	[4,990]	{2,495}	104,486	(20,897)	[5,015]	{2,508}

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.