

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

Date: 3/12/21

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 3/12/21 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.

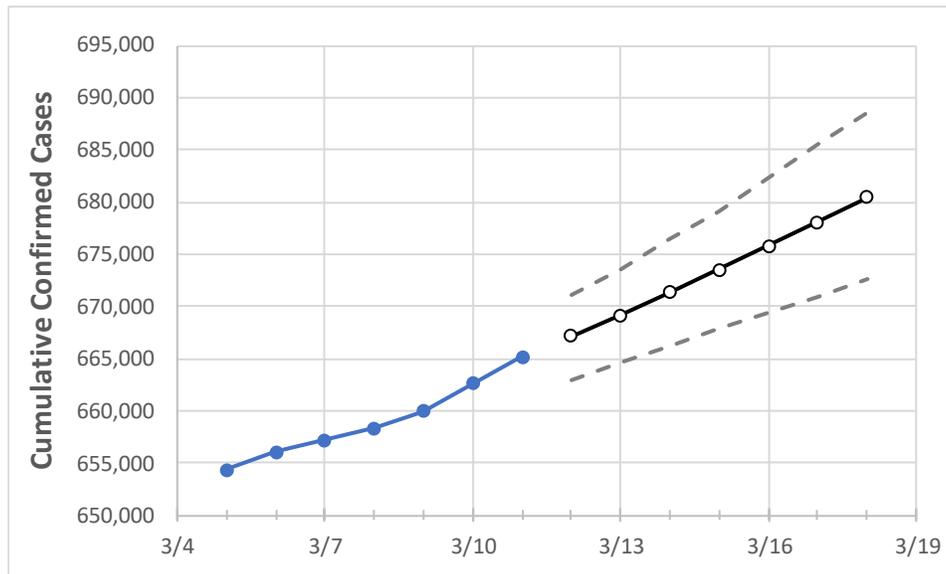
IEM's Modeling Lead

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:					
	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16	3/17	3/18	
Michigan	658,355	659,890	662,572	665,141	667,152	669,184	671,296	673,507	675,769	678,088	680,430	

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:							
	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16	3/17	3/18	
Genesee	26,204	26,276	26,409	26,528	26,632	26,741	26,854	26,973	27,097	27,228	27,363	
Ingham	16,761	16,798	16,899	16,961	17,018	17,075	17,134	17,194	17,255	17,320	17,387	
Kent	52,424	52,468	52,610	52,723	52,812	52,902	52,991	53,082	53,175	53,267	53,361	
Livingston	10,586	10,605	10,655	10,716	10,759	10,803	10,849	10,897	10,946	10,996	11,048	
Macomb	60,372	60,567	60,893	61,187	61,441	61,709	61,985	62,277	62,582	62,904	63,243	
Monroe	10,067	10,125	10,182	10,234	10,288	10,344	10,403	10,465	10,531	10,601	10,672	
Oakland	76,119	76,359	76,649	76,969	77,197	77,434	77,681	77,936	78,200	78,477	78,760	
Washtenaw	19,006	19,047	19,107	19,164	19,204	19,243	19,281	19,320	19,358	19,396	19,433	
Wayne	104,024	104,229	104,708	105,041	105,388	105,747	106,120	106,503	106,905	107,318	107,749	

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:											
	3/8	3/9	3/10	3/11	3/13				3/15				3/17			
Genesee	26,204	26,276	26,409	26,528	26,741	(5,348)	[1,284]	{642}	26,973	(5,395)	[1,295]	{647}	27,228	(5,446)	[1,307]	{653}
Ingham	16,761	16,798	16,899	16,961	17,075	(3,415)	[820]	{410}	17,194	(3,439)	[825]	{413}	17,320	(3,464)	[831]	{416}
Kent	52,424	52,468	52,610	52,723	52,902	(10,580)	[2,539]	{1,270}	53,082	(10,616)	[2,548]	{1,274}	53,267	(10,653)	[2,557]	{1,278}
Livingston	10,586	10,605	10,655	10,716	10,803	(2,161)	[519]	{259}	10,897	(2,179)	[523]	{262}	10,996	(2,199)	[528]	{264}
Macomb	60,372	60,567	60,893	61,187	61,709	(12,342)	[2,962]	{1,481}	62,277	(12,455)	[2,989]	{1,495}	62,904	(12,581)	[3,019]	{1,510}
Monroe	10,067	10,125	10,182	10,234	10,344	(2,069)	[497]	{248}	10,465	(2,093)	[502]	{251}	10,601	(2,120)	[509]	{254}
Oakland	76,119	76,359	76,649	76,969	77,434	(15,487)	[3,717]	{1,858}	77,936	(15,587)	[3,741]	{1,870}	78,477	(15,695)	[3,767]	{1,883}
Washtenaw	19,006	19,047	19,107	19,164	19,243	(3,849)	[924]	{462}	19,320	(3,864)	[927]	{464}	19,396	(3,879)	[931]	{466}
Wayne	104,024	104,229	104,708	105,041	105,747	(21,149)	[5,076]	{2,538}	106,503	(21,301)	[5,112]	{2,556}	107,318	(21,464)	[5,151]	{2,576}

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.