

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

Date: 3/9/21

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 3/9/21 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.

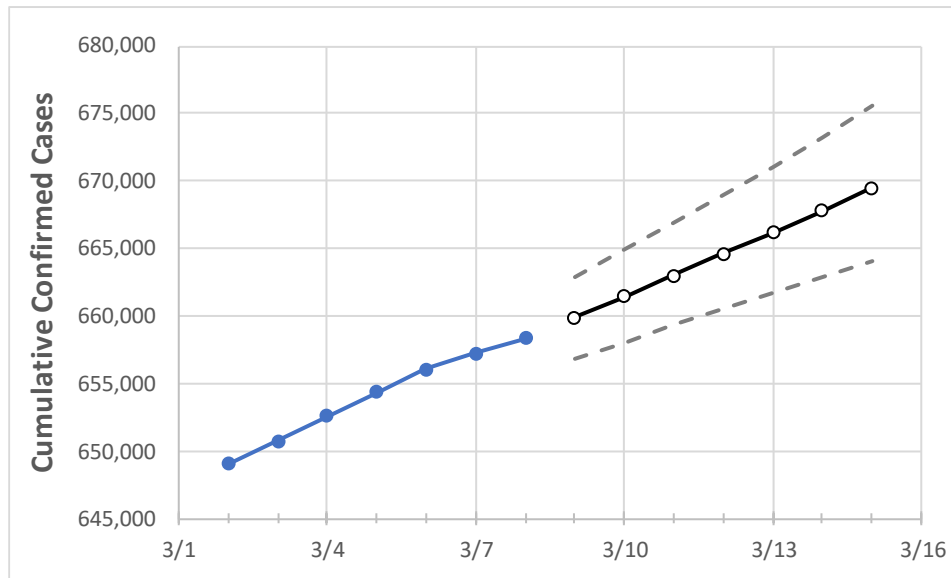
IEM's Modeling Lead

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:						
	3/5	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15
Michigan	654,380	656,072	657,214	658,355	659,909	661,459	663,023	664,596	666,193	667,824	669,466

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:						
	3/5	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15
Genesee	26,041	26,111	26,158	26,204	26,290	26,376	26,468	26,561	26,662	26,764	26,868
Ingham	16,617	16,689	16,725	16,761	16,805	16,850	16,893	16,938	16,983	17,027	17,073
Kent	52,231	52,304	52,364	52,424	52,498	52,572	52,644	52,717	52,789	52,860	52,932
Livingston	10,488	10,537	10,562	10,586	10,622	10,659	10,697	10,736	10,777	10,818	10,862
Macomb	59,941	60,150	60,261	60,372	60,565	60,760	60,964	61,170	61,382	61,604	61,836
Monroe	9,969	10,008	10,038	10,067	10,107	10,148	10,191	10,235	10,283	10,332	10,382
Oakland	75,649	75,863	75,991	76,119	76,278	76,437	76,597	76,754	76,918	77,080	77,240
Washtenaw	18,910	18,951	18,979	19,006	19,041	19,076	19,110	19,142	19,175	19,205	19,235
Wayne	103,282	103,560	103,792	104,024	104,319	104,622	104,934	105,255	105,588	105,928	106,283

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:											
	3/5	3/6	3/7	3/8	3/10				3/12				3/14			
Genesee	26,041	26,111	26,158	26,204	26,376	(5,275)	[1,266]	{633}	26,561	(5,312)	[1,275]	{637}	26,764	(5,353)	[1,285]	{642}
Ingham	16,617	16,689	16,725	16,761	16,850	(3,370)	[809]	{404}	16,938	(3,388)	[813]	{407}	17,027	(3,405)	[817]	{409}
Kent	52,231	52,304	52,364	52,424	52,572	(10,514)	[2,523]	{1,262}	52,717	(10,543)	[2,530]	{1,265}	52,860	(10,572)	[2,537]	{1,269}
Livingston	10,488	10,537	10,562	10,586	10,659	(2,132)	[512]	{256}	10,736	(2,147)	[515]	{258}	10,818	(2,164)	[519]	{260}
Macomb	59,941	60,150	60,261	60,372	60,760	(12,152)	[2,917]	{1,458}	61,170	(12,234)	[2,936]	{1,468}	61,604	(12,321)	[2,957]	{1,478}
Monroe	9,969	10,008	10,038	10,067	10,148	(2,030)	[487]	{244}	10,235	(2,047)	[491]	{246}	10,332	(2,066)	[496]	{248}
Oakland	75,649	75,863	75,991	76,119	76,437	(15,287)	[3,669]	{1,834}	76,754	(15,351)	[3,684]	{1,842}	77,080	(15,416)	[3,700]	{1,850}
Washtenaw	18,910	18,951	18,979	19,006	19,076	(3,815)	[916]	{458}	19,142	(3,828)	[919]	{459}	19,205	(3,841)	[922]	{461}
Wayne	103,282	103,560	103,792	104,024	104,622	(20,924)	[5,022]	{2,511}	105,255	(21,051)	[5,052]	{2,526}	105,928	(21,186)	[5,085]	{2,542}

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.