

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

Date: 2/4/21

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 2/4/21 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.

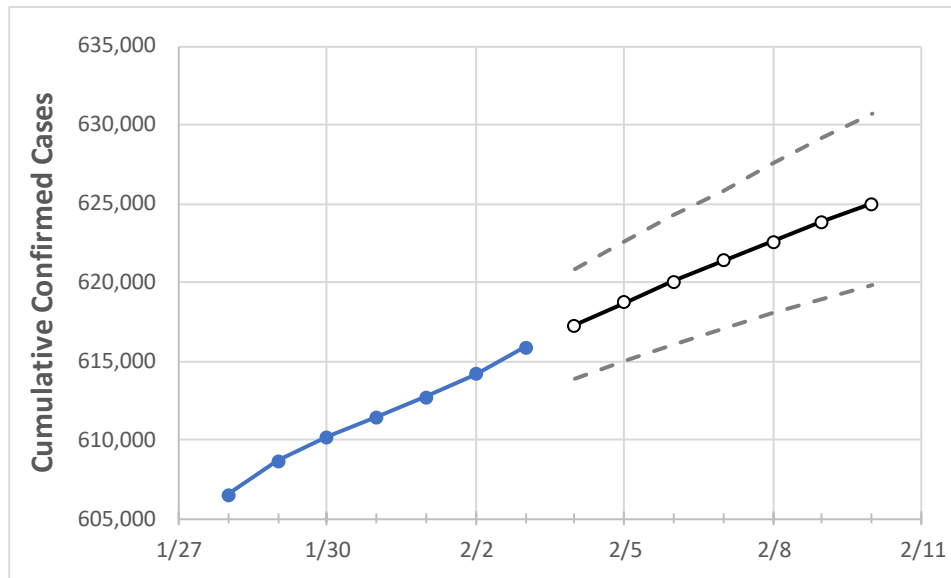
IEM's Modeling Lead

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:						
	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8	2/9	2/10
Michigan	611,424	612,710	614,143	615,860	617,286	618,714	620,073	621,362	622,602	623,818	624,987

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:						
	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8	2/9	2/10
Genesee	24,359	24,391	24,445	24,486	24,520	24,552	24,581	24,610	24,637	24,662	24,687
Ingham	15,066	15,126	15,174	15,267	15,329	15,390	15,451	15,512	15,572	15,632	15,693
Kent	49,332	49,421	49,516	49,660	49,758	49,855	49,946	50,035	50,124	50,210	50,293
Livingston	9,627	9,655	9,677	9,733	9,767	9,802	9,835	9,867	9,898	9,929	9,958
Macomb	55,954	56,055	56,176	56,293	56,417	56,538	56,660	56,776	56,889	57,005	57,111
Monroe	9,194	9,220	9,249	9,279	9,308	9,336	9,364	9,389	9,414	9,439	9,462
Oakland	70,626	70,804	71,009	71,177	71,341	71,498	71,654	71,804	71,949	72,095	72,237
Washtenaw	16,790	16,854	16,950	17,028	17,117	17,206	17,299	17,389	17,476	17,569	17,658
Wayne	96,853	97,021	97,228	97,402	97,604	97,800	97,986	98,163	98,334	98,503	98,668

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:											
	1/31	2/1	2/2	2/3	2/5				2/7				2/9			
Genesee	24,359	24,391	24,445	24,486	24,552	(4,910)	[1,178]	{589}	24,610	(4,922)	[1,181]	{591}	24,662	(4,932)	[1,184]	{592}
Ingham	15,066	15,126	15,174	15,267	15,390	(3,078)	[739]	{369}	15,512	(3,102)	[745]	{372}	15,632	(3,126)	[750]	{375}
Kent	49,332	49,421	49,516	49,660	49,855	(9,971)	[2,393]	{1,197}	50,035	(10,007)	[2,402]	{1,201}	50,210	(10,042)	[2,410]	{1,205}
Livingston	9,627	9,655	9,677	9,733	9,802	(1,960)	[470]	{235}	9,867	(1,973)	[474]	{237}	9,929	(1,986)	[477]	{238}
Macomb	55,954	56,055	56,176	56,293	56,538	(11,308)	[2,714]	{1,357}	56,776	(11,355)	[2,725]	{1,363}	57,005	(11,401)	[2,736]	{1,368}
Monroe	9,194	9,220	9,249	9,279	9,336	(1,867)	[448]	{224}	9,389	(1,878)	[451]	{225}	9,439	(1,888)	[453]	{227}
Oakland	70,626	70,804	71,009	71,177	71,498	(14,300)	[3,432]	{1,716}	71,804	(14,361)	[3,447]	{1,723}	72,095	(14,419)	[3,461]	{1,730}
Washtenaw	16,790	16,854	16,950	17,028	17,206	(3,441)	[826]	{413}	17,389	(3,478)	[835]	{417}	17,569	(3,514)	[843]	{422}
Wayne	96,853	97,021	97,228	97,402	97,800	(19,560)	[4,694]	{2,347}	98,163	(19,633)	[4,712]	{2,356}	98,503	(19,701)	[4,728]	{2,364}

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.