

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 2/10/21**

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 2/10/21 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.

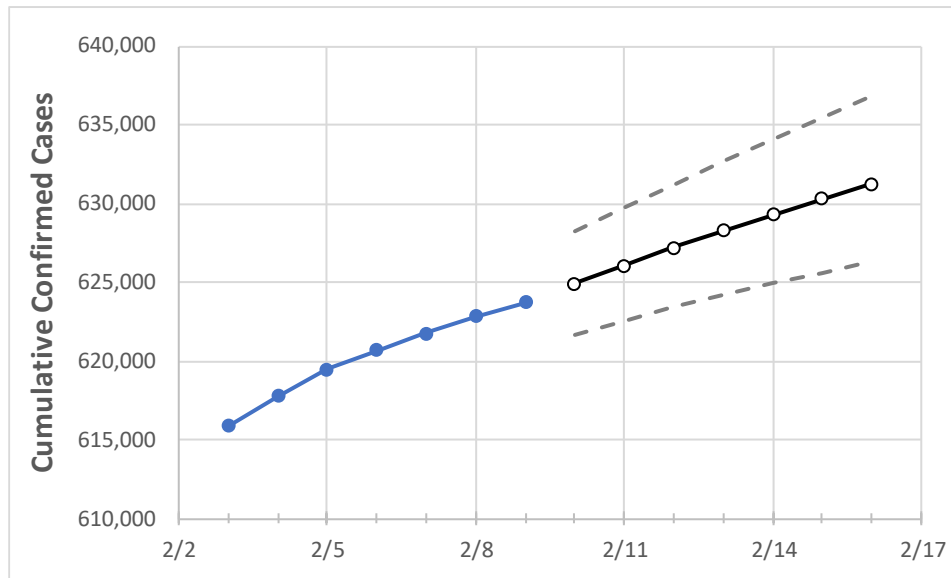
IEM's Modeling Lead

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:						
	2/6	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16
Michigan	620,685	621,749	622,813	623,731	624,930	626,079	627,184	628,254	629,286	630,283	631,251

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:						
	2/6	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16
Genesee	24,651	24,686	24,720	24,732	24,763	24,792	24,820	24,848	24,873	24,898	24,923
Ingham	15,476	15,532	15,588	15,616	15,674	15,731	15,788	15,845	15,899	15,954	16,008
Kent	49,976	50,035	50,094	50,158	50,236	50,308	50,380	50,447	50,512	50,575	50,635
Livingston	9,827	9,851	9,874	9,892	9,919	9,944	9,969	9,994	10,016	10,039	10,060
Macomb	56,708	56,801	56,893	56,964	57,057	57,149	57,239	57,326	57,410	57,487	57,562
Monroe	9,345	9,365	9,384	9,405	9,424	9,443	9,460	9,477	9,492	9,507	9,522
Oakland	71,810	71,944	72,077	72,246	72,411	72,570	72,725	72,876	73,026	73,172	73,315
Washtenaw	17,342	17,391	17,439	17,526	17,615	17,703	17,791	17,878	17,969	18,058	18,149
Wayne	98,130	98,327	98,524	98,632	98,804	98,972	99,134	99,291	99,438	99,586	99,733

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:											
	2/6	2/7	2/8	2/9	2/11				2/13				2/15			
Genesee	24,651	24,686	24,720	24,732	24,792	(4,958)	[1,190]	{595}	24,848	(4,970)	[1,193]	{596}	24,898	(4,980)	[1,195]	{598}
Ingham	15,476	15,532	15,588	15,616	15,731	(3,146)	[755]	{378}	15,845	(3,169)	[761]	{380}	15,954	(3,191)	[766]	{383}
Kent	49,976	50,035	50,094	50,158	50,308	(10,062)	[2,415]	{1,207}	50,447	(10,089)	[2,421]	{1,211}	50,575	(10,115)	[2,428]	{1,214}
Livingston	9,827	9,851	9,874	9,892	9,944	(1,989)	[477]	{239}	9,994	(1,999)	[480]	{240}	10,039	(2,008)	[482]	{241}
Macomb	56,708	56,801	56,893	56,964	57,149	(11,430)	[2,743]	{1,372}	57,326	(11,465)	[2,752]	{1,376}	57,487	(11,497)	[2,759]	{1,380}
Monroe	9,345	9,365	9,384	9,405	9,443	(1,889)	[453]	{227}	9,477	(1,895)	[455]	{227}	9,507	(1,901)	[456]	{228}
Oakland	71,810	71,944	72,077	72,246	72,570	(14,514)	[3,483]	{1,742}	72,876	(14,575)	[3,498]	{1,749}	73,172	(14,634)	[3,512]	{1,756}
Washtenaw	17,342	17,391	17,439	17,526	17,703	(3,541)	[850]	{425}	17,878	(3,576)	[858]	{429}	18,058	(3,612)	[867]	{433}
Wayne	98,130	98,327	98,524	98,632	98,972	(19,794)	[4,751]	{2,375}	99,291	(19,858)	[4,766]	{2,383}	99,586	(19,917)	[4,780]	{2,390}

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.