

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

Date: 2/23/21

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 2/23/21 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.

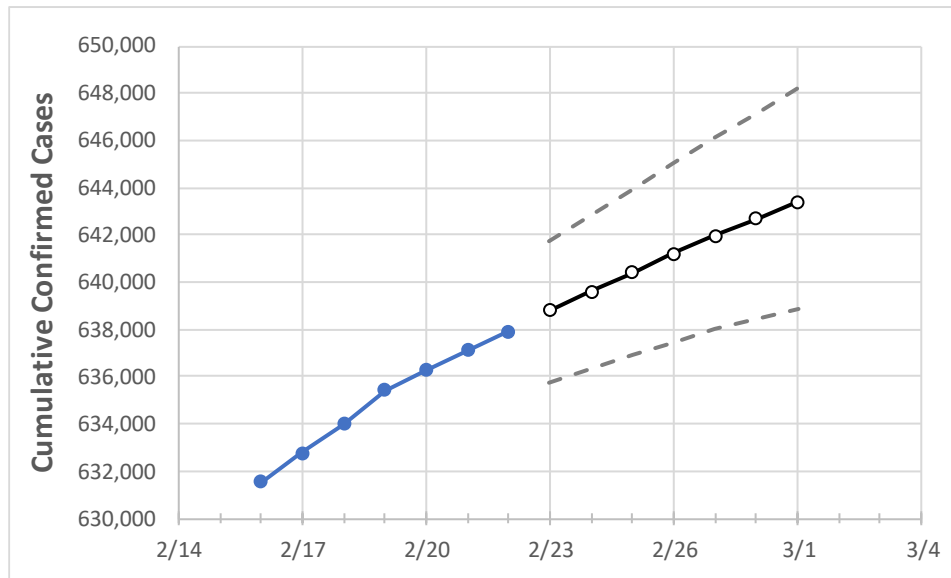
IEM's Modeling Lead

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Michigan	635,446	636,269	637,099	637,928	638,797	639,605	640,415	641,203	641,952	642,700	643,409

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Genesee	25,109	25,129	25,153	25,177	25,204	25,230	25,256	25,282	25,306	25,331	25,354
Ingham	16,080	16,090	16,114	16,138	16,167	16,196	16,223	16,251	16,278	16,303	16,327
Kent	51,092	51,149	51,205	51,260	51,330	51,397	51,461	51,526	51,587	51,648	51,708
Livingston	10,093	10,113	10,131	10,148	10,163	10,178	10,192	10,206	10,219	10,233	10,246
Macomb	57,907	58,002	58,087	58,172	58,249	58,325	58,400	58,474	58,544	58,612	58,681
Monroe	9,600	9,614	9,627	9,639	9,652	9,665	9,677	9,689	9,700	9,710	9,721
Oakland	73,653	73,744	73,833	73,922	74,027	74,128	74,226	74,321	74,417	74,507	74,594
Washtenaw	18,233	18,279	18,320	18,361	18,414	18,465	18,515	18,562	18,610	18,656	18,701
Wayne	100,239	100,372	100,507	100,642	100,772	100,898	101,022	101,142	101,263	101,380	101,492

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:											
	2/19	2/20	2/21	2/22	2/24				2/26				2/28			
Genesee	25,109	25,129	25,153	25,177	25,230	(5,046)	[1,211]	{606}	25,282	(5,056)	[1,214]	{607}	25,331	(5,066)	[1,216]	{608}
Ingham	16,080	16,090	16,114	16,138	16,196	(3,239)	[777]	{389}	16,251	(3,250)	[780]	{390}	16,303	(3,261)	[783]	{391}
Kent	51,092	51,149	51,205	51,260	51,397	(10,279)	[2,467]	{1,234}	51,526	(10,305)	[2,473]	{1,237}	51,648	(10,330)	[2,479]	{1,240}
Livingston	10,093	10,113	10,131	10,148	10,178	(2,036)	[489]	{244}	10,206	(2,041)	[490]	{245}	10,233	(2,047)	[491]	{246}
Macomb	57,907	58,002	58,087	58,172	58,325	(11,665)	[2,800]	{1,400}	58,474	(11,695)	[2,807]	{1,403}	58,612	(11,722)	[2,813]	{1,407}
Monroe	9,600	9,614	9,627	9,639	9,665	(1,933)	[464]	{232}	9,689	(1,938)	[465]	{233}	9,710	(1,942)	[466]	{233}
Oakland	73,653	73,744	73,833	73,922	74,128	(14,826)	[3,558]	{1,779}	74,321	(14,864)	[3,567]	{1,784}	74,507	(14,901)	[3,576]	{1,788}
Washtenaw	18,233	18,279	18,320	18,361	18,465	(3,693)	[886]	{443}	18,562	(3,712)	[891]	{445}	18,656	(3,731)	[895]	{448}
Wayne	100,239	100,372	100,507	100,642	100,898	(20,180)	[4,843]	{2,422}	101,142	(20,228)	[4,855]	{2,427}	101,380	(20,276)	[4,866]	{2,433}

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.