

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

Date: 12/17/21

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 12/17/21 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.

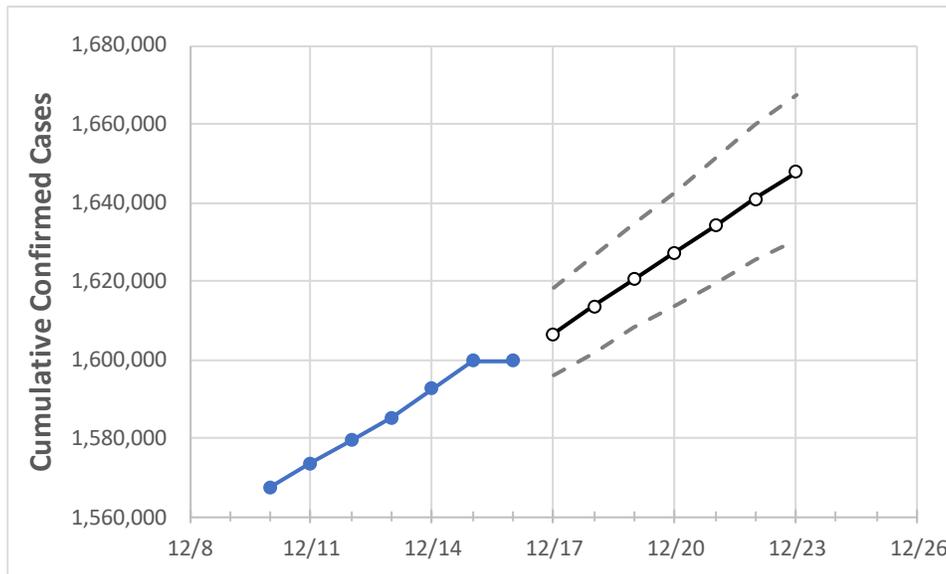
IEM's Modeling Lead

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:						
	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23
Michigan	1,585,297	1,592,488	1,599,679	1,599,679	1,606,579	1,613,701	1,620,306	1,627,308	1,634,079	1,640,907	1,647,673

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:						
	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23
Genesee	67,065	67,459	67,853	67,853	68,263	68,677	69,093	69,513	69,931	70,357	70,781
Ingham	39,111	39,311	39,510	39,510	39,680	39,852	40,019	40,188	40,359	40,528	40,696
Kent	116,164	116,558	116,952	116,952	117,327	117,692	118,061	118,413	118,766	119,109	119,458
Livingston	30,951	31,109	31,266	31,266	31,410	31,546	31,686	31,827	31,963	32,097	32,228
Macomb	150,902	151,633	152,363	152,363	153,071	153,771	154,470	155,165	155,851	156,560	157,245
Monroe	25,413	25,542	25,670	25,670	25,784	25,898	26,010	26,126	26,246	26,362	26,480
Oakland	181,037	181,913	182,789	182,789	183,606	184,421	185,224	186,031	186,827	187,643	188,412
Washtenaw	41,742	41,915	42,088	42,088	42,293	42,493	42,694	42,893	43,092	43,295	43,495
Wayne	245,773	247,180	248,586	248,586	249,860	251,136	252,422	253,729	255,029	256,331	257,699

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:											
	12/13	12/14	12/15	12/16	12/18			12/20			12/22					
Genesee	67,065	67,459	67,853	67,853	68,677	(13,735)	[3,296]	{1,648}	69,513	(13,903)	[3,337]	{1,668}	70,357	(14,071)	[3,377]	{1,689}
Ingham	39,111	39,311	39,510	39,510	39,852	(7,970)	[1,913]	{956}	40,188	(8,038)	[1,929]	{965}	40,528	(8,106)	[1,945]	{973}
Kent	116,164	116,558	116,952	116,952	117,692	(23,538)	[5,649]	{2,825}	118,413	(23,683)	[5,684]	{2,842}	119,109	(23,822)	[5,717]	{2,859}
Livingston	30,951	31,109	31,266	31,266	31,546	(6,309)	[1,514]	{757}	31,827	(6,365)	[1,528]	{764}	32,097	(6,419)	[1,541]	{770}
Macomb	150,902	151,633	152,363	152,363	153,771	(30,754)	[7,381]	{3,690}	155,165	(31,033)	[7,448]	{3,724}	156,560	(31,312)	[7,515]	{3,757}
Monroe	25,413	25,542	25,670	25,670	25,898	(5,180)	[1,243]	{622}	26,126	(5,225)	[1,254]	{627}	26,362	(5,272)	[1,265]	{633}
Oakland	181,037	181,913	182,789	182,789	184,421	(36,884)	[8,852]	{4,426}	186,031	(37,206)	[8,929]	{4,465}	187,643	(37,529)	[9,007]	{4,503}
Washtenaw	41,742	41,915	42,088	42,088	42,493	(8,499)	[2,040]	{1,020}	42,893	(8,579)	[2,059]	{1,029}	43,295	(8,659)	[2,078]	{1,039}
Wayne	245,773	247,180	248,586	248,586	251,136	(50,227)	[12,055]	{6,027}	253,729	(50,746)	[12,179]	{6,089}	256,331	(51,266)	[12,304]	{6,152}

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.