

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

Date: 2/1/21

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 2/1/21 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.

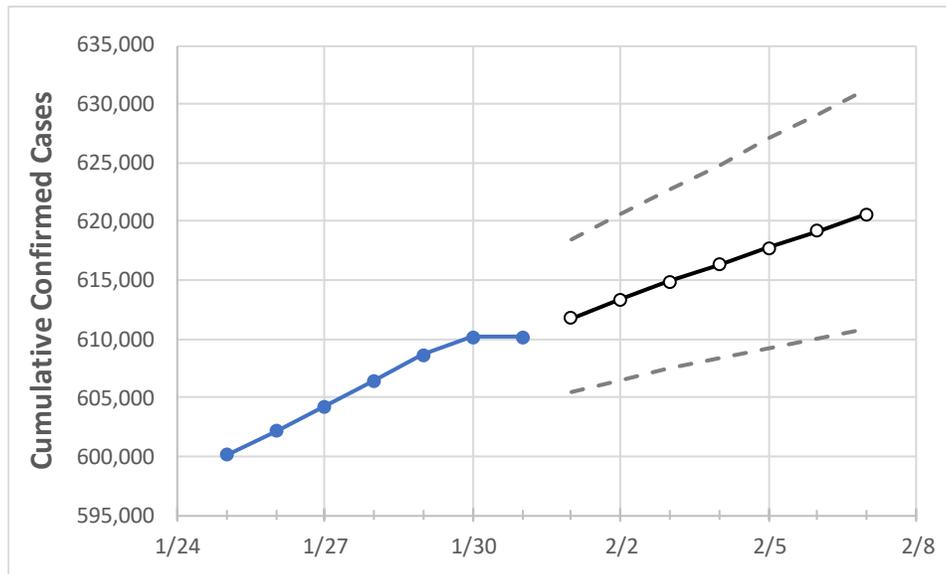
IEM's Modeling Lead

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:							
	1/28	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7	
Michigan	606,488	608,627	610,138	610,138	611,782	613,355	614,887	616,339	617,787	619,189	620,607	

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:							
	1/28	1/29	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7	
Genesee	24,250	24,288	24,327	24,327	24,366	24,404	24,440	24,473	24,505	24,535	24,565	
Ingham	14,862	14,962	15,006	15,006	15,066	15,125	15,185	15,247	15,304	15,361	15,418	
Kent	49,011	49,139	49,242	49,242	49,352	49,457	49,563	49,663	49,758	49,854	49,947	
Livingston	9,521	9,573	9,599	9,599	9,637	9,673	9,710	9,744	9,778	9,812	9,844	
Macomb	55,569	55,735	55,852	55,852	55,996	56,141	56,281	56,420	56,553	56,689	56,822	
Monroe	9,097	9,135	9,168	9,168	9,200	9,231	9,261	9,290	9,318	9,347	9,375	
Oakland	70,023	70,269	70,447	70,447	70,623	70,793	70,958	71,118	71,272	71,418	71,558	
Washtenaw	16,454	16,611	16,725	16,725	16,832	16,947	17,058	17,173	17,291	17,410	17,531	
Wayne	96,151	96,445	96,685	96,685	96,939	97,184	97,427	97,654	97,877	98,099	98,316	

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:											
	1/28	1/29	1/30	1/31	2/2			2/4			2/6					
Genesee	24,250	24,288	24,327	24,327	24,404	(4,881)	[1,171]	{586}	24,473	(4,895)	[1,175]	{587}	24,535	(4,907)	[1,178]	{589}
Ingham	14,862	14,962	15,006	15,006	15,125	(3,025)	[726]	{363}	15,247	(3,049)	[732]	{366}	15,361	(3,072)	[737]	{369}
Kent	49,011	49,139	49,242	49,242	49,457	(9,891)	[2,374]	{1,187}	49,663	(9,933)	[2,384]	{1,192}	49,854	(9,971)	[2,393]	{1,197}
Livingston	9,521	9,573	9,599	9,599	9,673	(1,935)	[464]	{232}	9,744	(1,949)	[468]	{234}	9,812	(1,962)	[471]	{235}
Macomb	55,569	55,735	55,852	55,852	56,141	(11,228)	[2,695]	{1,347}	56,420	(11,284)	[2,708]	{1,354}	56,689	(11,338)	[2,721]	{1,361}
Monroe	9,097	9,135	9,168	9,168	9,231	(1,846)	[443]	{222}	9,290	(1,858)	[446]	{223}	9,347	(1,869)	[449]	{224}
Oakland	70,023	70,269	70,447	70,447	70,793	(14,159)	[3,398]	{1,699}	71,118	(14,224)	[3,414]	{1,707}	71,418	(14,284)	[3,428]	{1,714}
Washtenaw	16,454	16,611	16,725	16,725	16,947	(3,389)	[813]	{407}	17,173	(3,435)	[824]	{412}	17,410	(3,482)	[836]	{418}
Wayne	96,151	96,445	96,685	96,685	97,184	(19,437)	[4,665]	{2,332}	97,654	(19,531)	[4,687]	{2,344}	98,099	(19,620)	[4,709]	{2,354}

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.