

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

Date: 3/30/21

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 3/30/21 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.

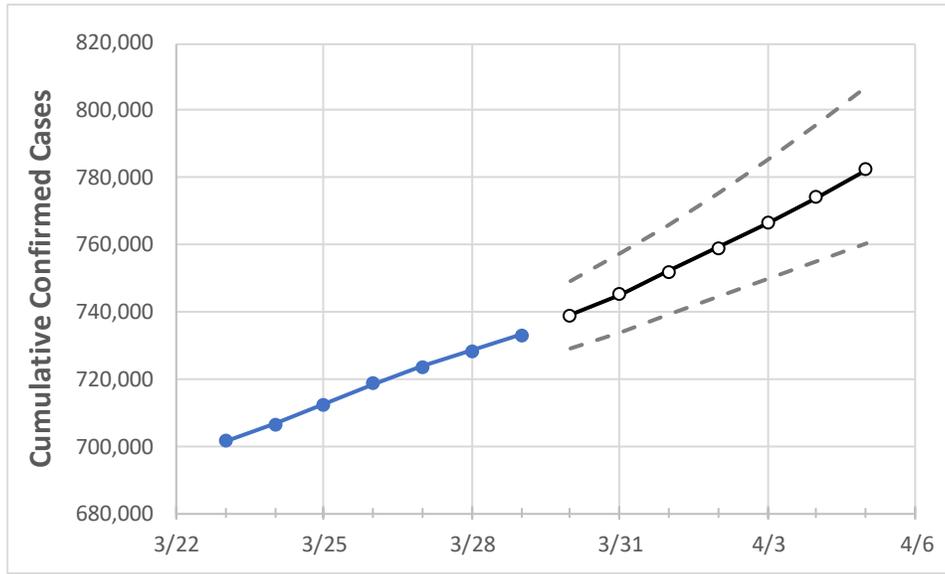
IEM's Modeling Lead

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:					
	3/26	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	
Michigan	718,455	723,700	728,319	732,938	739,002	745,312	751,920	759,060	766,431	774,205	782,376	

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:							
	3/26	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	
Genesee	29,055	29,401	29,572	29,742	30,020	30,310	30,618	30,937	31,273	31,625	31,995	
Ingham	18,644	18,753	18,891	19,028	19,206	19,395	19,590	19,787	20,001	20,224	20,455	
Kent	55,160	55,430	55,679	55,927	56,235	56,561	56,907	57,284	57,684	58,107	58,554	
Livingston	11,747	11,860	11,963	12,066	12,188	12,314	12,448	12,589	12,738	12,893	13,061	
Macomb	68,315	69,100	69,854	70,608	71,559	72,580	73,673	74,838	76,072	77,381	78,771	
Monroe	11,144	11,197	11,251	11,304	11,380	11,458	11,541	11,623	11,707	11,794	11,885	
Oakland	84,210	84,984	85,616	86,247	87,094	87,987	88,924	89,921	90,959	92,090	93,270	
Washtenaw	20,295	20,434	20,548	20,662	20,811	20,971	21,139	21,322	21,510	21,718	21,933	
Wayne	113,931	114,811	115,712	116,612	117,712	118,871	120,092	121,388	122,780	124,256	125,832	

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:											
	3/26	3/27	3/28	3/29	3/31				4/2				4/4			
Genesee	29,055	29,401	29,572	29,742	30,310	(6,062)	[1,455]	{727}	30,937	(6,187)	[1,485]	{742}	31,625	(6,325)	[1,518]	{759}
Ingham	18,644	18,753	18,891	19,028	19,395	(3,879)	[931]	{465}	19,787	(3,957)	[950]	{475}	20,224	(4,045)	[971]	{485}
Kent	55,160	55,430	55,679	55,927	56,561	(11,312)	[2,715]	{1,357}	57,284	(11,457)	[2,750]	{1,375}	58,107	(11,621)	[2,789]	{1,395}
Livingston	11,747	11,860	11,963	12,066	12,314	(2,463)	[591]	{296}	12,589	(2,518)	[604]	{302}	12,893	(2,579)	[619]	{309}
Macomb	68,315	69,100	69,854	70,608	72,580	(14,516)	[3,484]	{1,742}	74,838	(14,968)	[3,592]	{1,796}	77,381	(15,476)	[3,714]	{1,857}
Monroe	11,144	11,197	11,251	11,304	11,458	(2,292)	[550]	{275}	11,623	(2,325)	[558]	{279}	11,794	(2,359)	[566]	{283}
Oakland	84,210	84,984	85,616	86,247	87,987	(17,597)	[4,223]	{2,112}	89,921	(17,984)	[4,316]	{2,158}	92,090	(18,418)	[4,420]	{2,210}
Washtenaw	20,295	20,434	20,548	20,662	20,971	(4,194)	[1,007]	{503}	21,322	(4,264)	[1,023]	{512}	21,718	(4,344)	[1,042]	{521}
Wayne	113,931	114,811	115,712	116,612	118,871	(23,774)	[5,706]	{2,853}	121,388	(24,278)	[5,827]	{2,913}	124,256	(24,851)	[5,964]	{2,982}

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.