

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

Date: 5/5/21

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 5/5/21 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.

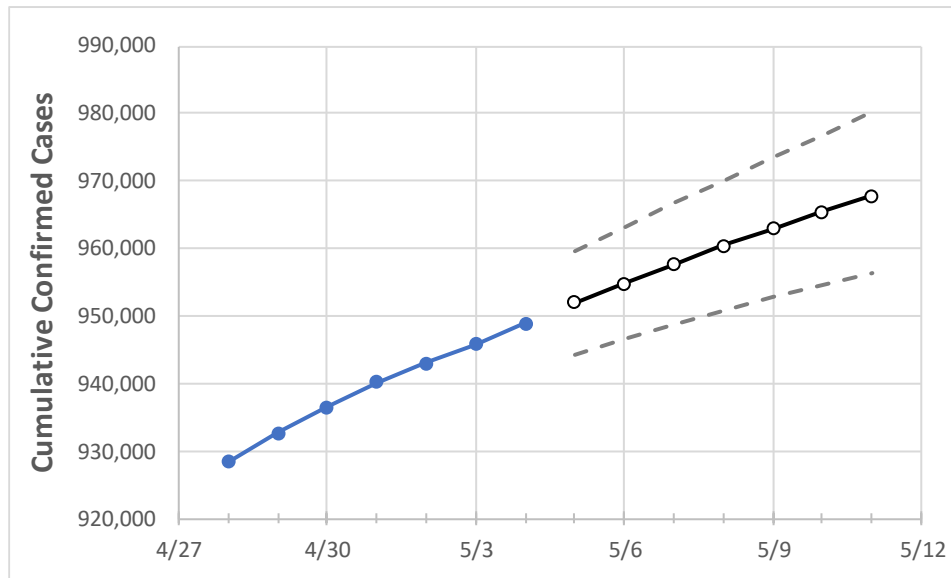
IEM's Modeling Lead

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:						
	5/1	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10	5/11
Michigan	940,175	942,954	945,732	948,852	951,930	954,855	957,647	960,364	962,907	965,484	967,865

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:						
	5/1	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10	5/11
Genesee	39,733	39,870	40,007	40,138	40,284	40,419	40,551	40,680	40,801	40,919	41,029
Ingham	23,709	23,756	23,803	23,876	23,933	23,991	24,044	24,094	24,143	24,189	24,233
Kent	68,438	68,694	68,950	69,152	69,401	69,636	69,872	70,103	70,322	70,540	70,750
Livingston	15,876	15,923	15,970	16,010	16,064	16,116	16,166	16,215	16,261	16,305	16,347
Macomb	94,975	95,261	95,546	95,874	96,159	96,429	96,685	96,924	97,152	97,373	97,584
Monroe	14,574	14,619	14,663	14,730	14,774	14,818	14,859	14,900	14,938	14,974	15,009
Oakland	111,429	111,684	111,939	112,263	112,606	112,929	113,236	113,526	113,803	114,073	114,322
Washtenaw	25,449	25,498	25,546	25,592	25,644	25,692	25,737	25,780	25,820	25,858	25,895
Wayne	155,417	155,991	156,564	157,029	157,569	158,096	158,594	159,068	159,528	159,986	160,411

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:											
	5/1	5/2	5/3	5/4	5/6				5/8				5/10			
Genesee	39,733	39,870	40,007	40,138	40,419	(8,084)	[1,940]	{970}	40,680	(8,136)	[1,953]	{976}	40,919	(8,184)	[1,964]	{982}
Ingham	23,709	23,756	23,803	23,876	23,991	(4,798)	[1,152]	{576}	24,094	(4,819)	[1,157]	{578}	24,189	(4,838)	[1,161]	{581}
Kent	68,438	68,694	68,950	69,152	69,636	(13,927)	[3,343]	{1,671}	70,103	(14,021)	[3,365]	{1,682}	70,540	(14,108)	[3,386]	{1,693}
Livingston	15,876	15,923	15,970	16,010	16,116	(3,223)	[774]	{387}	16,215	(3,243)	[778]	{389}	16,305	(3,261)	[783]	{391}
Macomb	94,975	95,261	95,546	95,874	96,429	(19,286)	[4,629]	{2,314}	96,924	(19,385)	[4,652]	{2,326}	97,373	(19,475)	[4,674]	{2,337}
Monroe	14,574	14,619	14,663	14,730	14,818	(2,964)	[711]	{356}	14,900	(2,980)	[715]	{358}	14,974	(2,995)	[719]	{359}
Oakland	111,429	111,684	111,939	112,263	112,929	(22,586)	[5,421]	{2,710}	113,526	(22,705)	[5,449]	{2,725}	114,073	(22,815)	[5,475]	{2,738}
Washtenaw	25,449	25,498	25,546	25,592	25,692	(5,138)	[1,233]	{617}	25,780	(5,156)	[1,237]	{619}	25,858	(5,172)	[1,241]	{621}
Wayne	155,417	155,991	156,564	157,029	158,096	(31,619)	[7,589]	{3,794}	159,068	(31,814)	[7,635]	{3,818}	159,986	(31,997)	[7,679]	{3,840}

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.