

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

Date: 5/11/21

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 5/11/21 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.

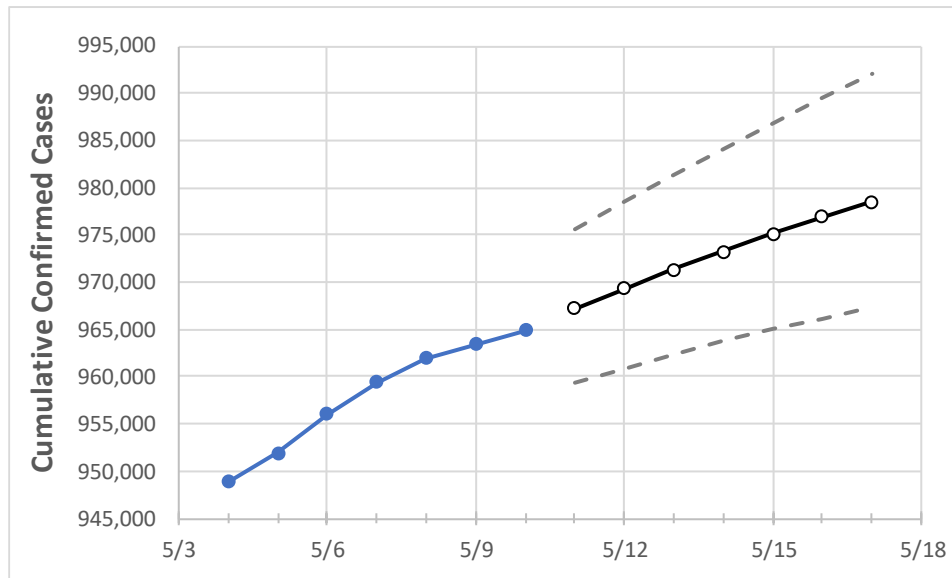
IEM's Modeling Lead

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:						
	5/7	5/8	5/9	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17
Michigan	959,379	961,956	963,450	964,943	967,173	969,321	971,332	973,245	975,100	976,893	978,556

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:						
	5/7	5/8	5/9	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17
Genesee	40,480	40,639	40,684	40,729	40,818	40,900	40,980	41,054	41,125	41,191	41,253
Ingham	24,058	24,100	24,140	24,180	24,220	24,257	24,292	24,326	24,358	24,388	24,417
Kent	69,854	70,012	70,138	70,263	70,433	70,598	70,753	70,900	71,041	71,174	71,303
Livingston	16,145	16,194	16,218	16,241	16,277	16,311	16,343	16,373	16,402	16,428	16,453
Macomb	96,822	97,068	97,193	97,317	97,514	97,699	97,872	98,037	98,189	98,329	98,468
Monroe	14,878	14,912	14,942	14,972	15,008	15,044	15,078	15,109	15,140	15,170	15,199
Oakland	113,840	114,310	114,436	114,561	114,859	115,145	115,423	115,681	115,938	116,181	116,424
Washtenaw	25,790	25,836	25,861	25,885	25,923	25,959	25,993	26,025	26,056	26,085	26,112
Wayne	158,792	159,167	159,456	159,745	160,114	160,468	160,799	161,115	161,416	161,690	161,960

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:											
	5/7	5/8	5/9	5/10	5/12				5/14				5/16			
Genesee	40,480	40,639	40,684	40,729	40,900	(8,180)	[1,963]	{982}	41,054	(8,211)	[1,971]	{985}	41,191	(8,238)	[1,977]	{989}
Ingham	24,058	24,100	24,140	24,180	24,257	(4,851)	[1,164]	{582}	24,326	(4,865)	[1,168]	{584}	24,388	(4,878)	[1,171]	{585}
Kent	69,854	70,012	70,138	70,263	70,598	(14,120)	[3,389]	{1,694}	70,900	(14,180)	[3,403]	{1,702}	71,174	(14,235)	[3,416]	{1,708}
Livingston	16,145	16,194	16,218	16,241	16,311	(3,262)	[783]	{391}	16,373	(3,275)	[786]	{393}	16,428	(3,286)	[789]	{394}
Macomb	96,822	97,068	97,193	97,317	97,699	(19,540)	[4,690]	{2,345}	98,037	(19,607)	[4,706]	{2,353}	98,329	(19,666)	[4,720]	{2,360}
Monroe	14,878	14,912	14,942	14,972	15,044	(3,009)	[722]	{361}	15,109	(3,022)	[725]	{363}	15,170	(3,034)	[728]	{364}
Oakland	113,840	114,310	114,436	114,561	115,145	(23,029)	[5,527]	{2,763}	115,681	(23,136)	[5,553]	{2,776}	116,181	(23,236)	[5,577]	{2,788}
Washtenaw	25,790	25,836	25,861	25,885	25,959	(5,192)	[1,246]	{623}	26,025	(5,205)	[1,249]	{625}	26,085	(5,217)	[1,252]	{626}
Wayne	158,792	159,167	159,456	159,745	160,468	(32,094)	[7,702]	{3,851}	161,115	(32,223)	[7,734]	{3,867}	161,690	(32,338)	[7,761]	{3,881}

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.