

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

Date: 5/4/21

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 5/4/21 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.**

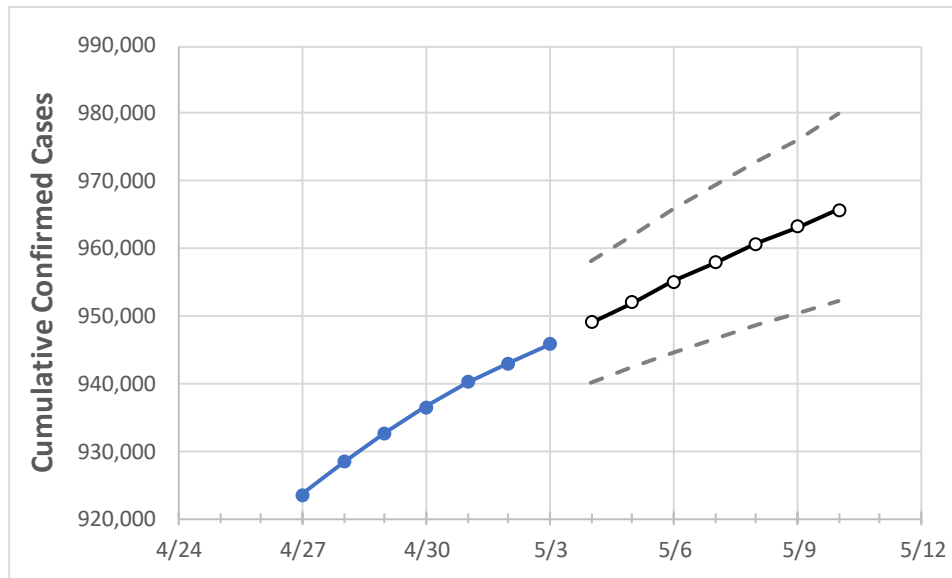
### IEM's Modeling Lead

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:							
	4/30	5/1	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10	
Michigan	936,467	940,175	942,954	945,732	949,018	952,071	955,102	957,965	960,687	963,274	965,736	

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:							
	4/30	5/1	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10	
Genesee	39,590	39,733	39,870	40,007	40,166	40,313	40,457	40,597	40,729	40,856	40,976	
Ingham	23,640	23,709	23,756	23,803	23,860	23,914	23,965	24,014	24,061	24,106	24,148	
Kent	68,100	68,438	68,694	68,950	69,212	69,467	69,718	69,962	70,199	70,433	70,661	
Livingston	15,806	15,876	15,923	15,970	16,030	16,086	16,140	16,191	16,241	16,289	16,335	
Macomb	94,581	94,975	95,261	95,546	95,859	96,155	96,426	96,687	96,932	97,161	97,369	
Monroe	14,540	14,574	14,619	14,663	14,708	14,751	14,791	14,830	14,869	14,906	14,941	
Oakland	110,917	111,429	111,684	111,939	112,306	112,656	113,003	113,333	113,651	113,949	114,233	
Washtenaw	25,372	25,449	25,498	25,546	25,601	25,652	25,702	25,748	25,792	25,832	25,871	
Wayne	154,782	155,417	155,991	156,564	157,148	157,731	158,288	158,833	159,340	159,830	160,295	

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:											
	4/30	5/1	5/2	5/3	5/5			5/7			5/9					
Genesee	39,590	39,733	39,870	40,007	40,313	(8,063)	[1,935]	{968}	40,597	(8,119)	[1,949]	{974}	40,856	(8,171)	[1,961]	{981}
Ingham	23,640	23,709	23,756	23,803	23,914	(4,783)	[1,148]	{574}	24,014	(4,803)	[1,153]	{576}	24,106	(4,821)	[1,157]	{579}
Kent	68,100	68,438	68,694	68,950	69,467	(13,893)	[3,334]	{1,667}	69,962	(13,992)	[3,358]	{1,679}	70,433	(14,087)	[3,381]	{1,690}
Livingston	15,806	15,876	15,923	15,970	16,086	(3,217)	[772]	{386}	16,191	(3,238)	[777]	{389}	16,289	(3,258)	[782]	{391}
Macomb	94,581	94,975	95,261	95,546	96,155	(19,231)	[4,615]	{2,308}	96,687	(19,337)	[4,641]	{2,320}	97,161	(19,432)	[4,664]	{2,332}
Monroe	14,540	14,574	14,619	14,663	14,751	(2,950)	[708]	{354}	14,830	(2,966)	[712]	{356}	14,906	(2,981)	[715]	{358}
Oakland	110,917	111,429	111,684	111,939	112,656	(22,531)	[5,407]	{2,704}	113,333	(22,667)	[5,440]	{2,720}	113,949	(22,790)	[5,470]	{2,735}
Washtenaw	25,372	25,449	25,498	25,546	25,652	(5,130)	[1,231]	{616}	25,748	(5,150)	[1,236]	{618}	25,832	(5,166)	[1,240]	{620}
Wayne	154,782	155,417	155,991	156,564	157,731	(31,546)	[7,571]	{3,786}	158,833	(31,767)	[7,624]	{3,812}	159,830	(31,966)	[7,672]	{3,836}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at [bryan.koon@iem.com](mailto:bryan.koon@iem.com) or 850-519-7966 or Stephanie Tennyson at [stephanie.tennyson@iem.com](mailto:stephanie.tennyson@iem.com) or 202-309-4257.