

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

Date: 2/16/22

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 2/16/22 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.**

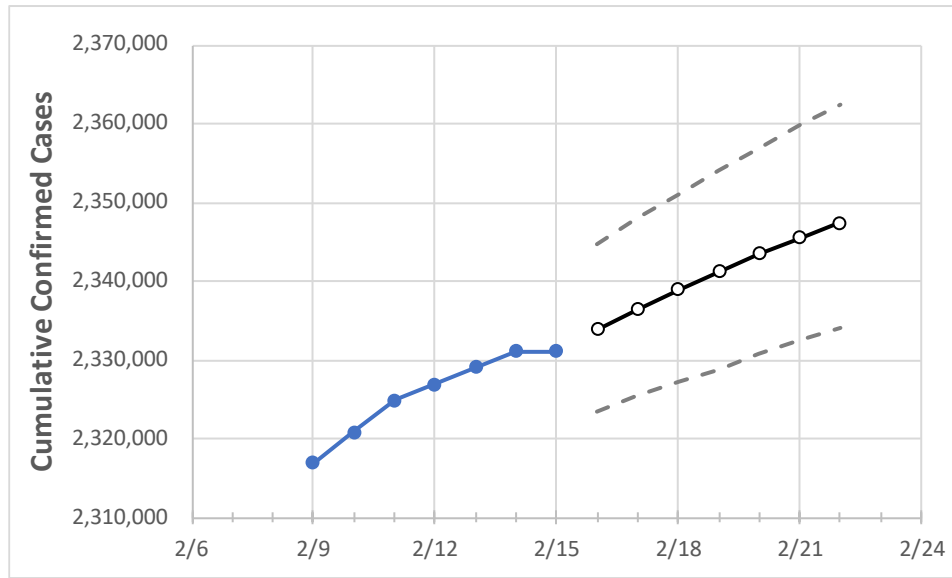
### IEM's Modeling Lead

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:							
	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	
Michigan	2,326,937	2,329,019	2,331,102	2,331,102	2,333,878	2,336,475	2,338,933	2,341,177	2,343,541	2,345,586	2,347,419	

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:							
	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	
Genesee	98,719	98,774	98,829	98,829	98,947	99,060	99,164	99,266	99,362	99,448	99,535	
Ingham	62,056	62,118	62,181	62,181	62,261	62,342	62,412	62,478	62,544	62,618	62,668	
Kent	162,582	162,732	162,882	162,882	163,065	163,230	163,382	163,529	163,674	163,804	163,932	
Livingston	44,645	44,674	44,704	44,704	44,736	44,764	44,792	44,818	44,843	44,867	44,888	
Macomb	221,758	221,916	222,073	222,073	222,295	222,489	222,673	222,858	223,011	223,190	223,333	
Monroe	37,149	37,182	37,214	37,214	37,251	37,288	37,322	37,352	37,384	37,411	37,439	
Oakland	278,097	278,362	278,626	278,626	278,943	279,235	279,505	279,766	280,030	280,265	280,491	
Washtenaw	71,062	71,153	71,245	71,245	71,347	71,449	71,541	71,636	71,719	71,802	71,882	
Wayne	388,292	388,533	388,773	388,773	389,155	389,504	389,829	390,160	390,455	390,746	390,990	

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:											
	2/12	2/13	2/14	2/15	2/17		2/19		2/21							
Genesee	98,719	98,774	98,829	98,829	99,060	(19,812)	[4,755]	{2,377}	99,266	(19,853)	[4,765]	{2,382}	99,448	(19,890)	[4,774]	{2,387}
Ingham	62,056	62,118	62,181	62,181	62,342	(12,468)	[2,992]	{1,496}	62,478	(12,496)	[2,999]	{1,499}	62,618	(12,524)	[3,006]	{1,503}
Kent	162,582	162,732	162,882	162,882	163,230	(32,646)	[7,835]	{3,918}	163,529	(32,706)	[7,849]	{3,925}	163,804	(32,761)	[7,863]	{3,931}
Livingston	44,645	44,674	44,704	44,704	44,764	(8,953)	[2,149]	{1,074}	44,818	(8,964)	[2,151]	{1,076}	44,867	(8,973)	[2,154]	{1,077}
Macomb	221,758	221,916	222,073	222,073	222,489	(44,498)	[10,679]	{5,340}	222,858	(44,572)	[10,697]	{5,349}	223,190	(44,638)	[10,713]	{5,357}
Monroe	37,149	37,182	37,214	37,214	37,288	(7,458)	[1,790]	{895}	37,352	(7,470)	[1,793]	{896}	37,411	(7,482)	[1,796]	{898}
Oakland	278,097	278,362	278,626	278,626	279,235	(55,847)	[13,403]	{6,702}	279,766	(55,953)	[13,429]	{6,714}	280,265	(56,053)	[13,453]	{6,726}
Washtenaw	71,062	71,153	71,245	71,245	71,449	(14,290)	[3,430]	{1,715}	71,636	(14,327)	[3,439]	{1,719}	71,802	(14,360)	[3,447]	{1,723}
Wayne	388,292	388,533	388,773	388,773	389,504	(77,901)	[18,696]	{9,348}	390,160	(78,032)	[18,728]	{9,364}	390,746	(78,149)	[18,756]	{9,378}

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.