

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

Date: 1/22/21

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 1/22/21 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.

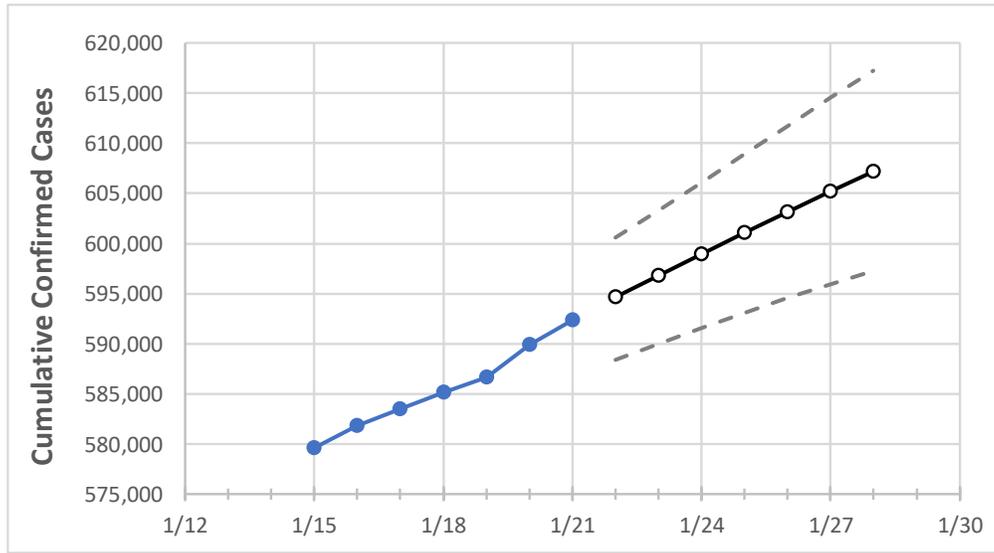
IEM's Modeling Lead

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:							
	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	
Michigan	585,128	586,673	589,869	592,382	594,631	596,804	598,968	601,074	603,128	605,175	607,210	

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:							
	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	
Genesee	23,602	23,673	23,760	23,839	23,924	24,004	24,084	24,160	24,235	24,306	24,377	
Ingham	14,155	14,230	14,310	14,405	14,486	14,566	14,646	14,726	14,806	14,890	14,970	
Kent	47,486	47,631	47,826	48,029	48,197	48,363	48,527	48,685	48,841	48,993	49,139	
Livingston	9,044	9,088	9,132	9,204	9,254	9,303	9,353	9,400	9,448	9,494	9,539	
Macomb	53,699	53,878	54,111	54,315	54,493	54,677	54,853	55,025	55,197	55,364	55,525	
Monroe	8,690	8,732	8,774	8,825	8,869	8,913	8,956	8,998	9,041	9,082	9,124	
Oakland	67,674	67,987	68,244	68,496	68,759	69,022	69,277	69,527	69,775	70,012	70,246	
Washtenaw	15,517	15,602	15,710	15,778	15,858	15,936	16,014	16,089	16,165	16,239	16,312	
Wayne	92,976	93,373	93,737	94,091	94,443	94,791	95,137	95,476	95,805	96,124	96,445	

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:											
	1/18	1/19	1/20	1/21	1/23				1/25				1/27			
Genesee	23,602	23,673	23,760	23,839	24,004	(4,801)	[1,152]	{576}	24,160	(4,832)	[1,160]	{580}	24,306	(4,861)	[1,167]	{583}
Ingham	14,155	14,230	14,310	14,405	14,566	(2,913)	[699]	{350}	14,726	(2,945)	[707]	{353}	14,890	(2,978)	[715]	{357}
Kent	47,486	47,631	47,826	48,029	48,363	(9,673)	[2,321]	{1,161}	48,685	(9,737)	[2,337]	{1,168}	48,993	(9,799)	[2,352]	{1,176}
Livingston	9,044	9,088	9,132	9,204	9,303	(1,861)	[447]	{223}	9,400	(1,880)	[451]	{226}	9,494	(1,899)	[456]	{228}
Macomb	53,699	53,878	54,111	54,315	54,677	(10,935)	[2,624]	{1,312}	55,025	(11,005)	[2,641]	{1,321}	55,364	(11,073)	[2,657]	{1,329}
Monroe	8,690	8,732	8,774	8,825	8,913	(1,783)	[428]	{214}	8,998	(1,800)	[432]	{216}	9,082	(1,816)	[436]	{218}
Oakland	67,674	67,987	68,244	68,496	69,022	(13,804)	[3,313]	{1,657}	69,527	(13,905)	[3,337]	{1,669}	70,012	(14,002)	[3,361]	{1,680}
Washtenaw	15,517	15,602	15,710	15,778	15,936	(3,187)	[765]	{382}	16,089	(3,218)	[772]	{386}	16,239	(3,248)	[779]	{390}
Wayne	92,976	93,373	93,737	94,091	94,791	(18,958)	[4,550]	{2,275}	95,476	(19,095)	[4,583]	{2,291}	96,124	(19,225)	[4,614]	{2,307}

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.