

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

Date: 7/12/21

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 7/12/21 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.

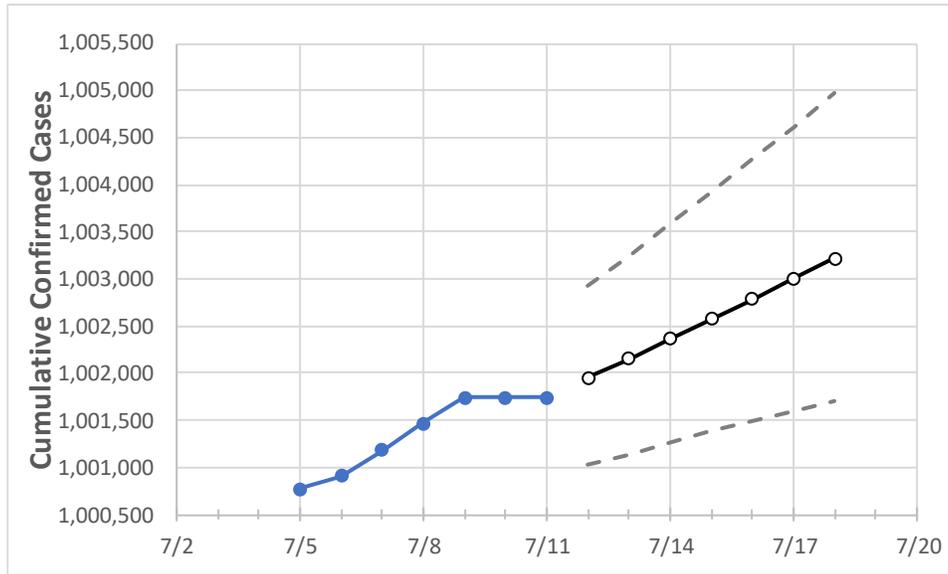
IEM's Modeling Lead

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:							
	7/8	7/9	7/10	7/11	7/12	7/13	7/14	7/15	7/16	7/17	7/18	
Michigan	1,001,466	1,001,745	1,001,745	1,001,745	1,001,954	1,002,156	1,002,367	1,002,577	1,002,786	1,003,007	1,003,219	

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:							
	7/8	7/9	7/10	7/11	7/12	7/13	7/14	7/15	7/16	7/17	7/18	
Genesee	41,789	41,795	41,795	41,795	41,799	41,804	41,808	41,813	41,818	41,822	41,827	
Ingham	24,938	24,943	24,943	24,943	24,947	24,951	24,955	24,959	24,963	24,967	24,971	
Kent	73,861	73,907	73,907	73,907	73,947	73,988	74,028	74,068	74,108	74,148	74,192	
Livingston	16,778	16,783	16,783	16,783	16,786	16,789	16,793	16,796	16,799	16,802	16,806	
Macomb	100,318	100,340	100,340	100,340	100,353	100,366	100,380	100,393	100,406	100,419	100,433	
Monroe	15,447	15,449	15,449	15,449	15,452	15,454	15,457	15,459	15,462	15,464	15,467	
Oakland	118,932	118,968	118,968	118,968	118,994	119,020	119,048	119,075	119,103	119,132	119,160	
Washtenaw	26,541	26,547	26,547	26,547	26,551	26,555	26,560	26,564	26,569	26,573	26,577	
Wayne	166,293	166,343	166,343	166,343	166,393	166,444	166,494	166,547	166,598	166,650	166,702	

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:											
	7/8	7/9	7/10	7/11	7/13			7/15			7/17					
Genesee	41,789	41,795	41,795	41,795	41,804	(8,361)	[2,007]	{1,003}	41,813	(8,363)	[2,007]	{1,004}	41,822	(8,364)	[2,007]	{1,004}
Ingham	24,938	24,943	24,943	24,943	24,951	(4,990)	[1,198]	{599}	24,959	(4,992)	[1,198]	{599}	24,967	(4,993)	[1,198]	{599}
Kent	73,861	73,907	73,907	73,907	73,988	(14,798)	[3,551]	{1,776}	74,068	(14,814)	[3,555]	{1,778}	74,148	(14,830)	[3,559]	{1,780}
Livingston	16,778	16,783	16,783	16,783	16,789	(3,358)	[806]	{403}	16,796	(3,359)	[806]	{403}	16,802	(3,360)	[807]	{403}
Macomb	100,318	100,340	100,340	100,340	100,366	(20,073)	[4,818]	{2,409}	100,393	(20,079)	[4,819]	{2,409}	100,419	(20,084)	[4,820]	{2,410}
Monroe	15,447	15,449	15,449	15,449	15,454	(3,091)	[742]	{371}	15,459	(3,092)	[742]	{371}	15,464	(3,093)	[742]	{371}
Oakland	118,932	118,968	118,968	118,968	119,020	(23,804)	[5,713]	{2,856}	119,075	(23,815)	[5,716]	{2,858}	119,132	(23,826)	[5,718]	{2,859}
Washtenaw	26,541	26,547	26,547	26,547	26,555	(5,311)	[1,275]	{637}	26,564	(5,313)	[1,275]	{638}	26,573	(5,315)	[1,276]	{638}
Wayne	166,293	166,343	166,343	166,343	166,444	(33,289)	[7,989]	{3,995}	166,547	(33,309)	[7,994]	{3,997}	166,650	(33,330)	[7,999]	{4,000}

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.