

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 3/17/21**

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 3/17/21 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.

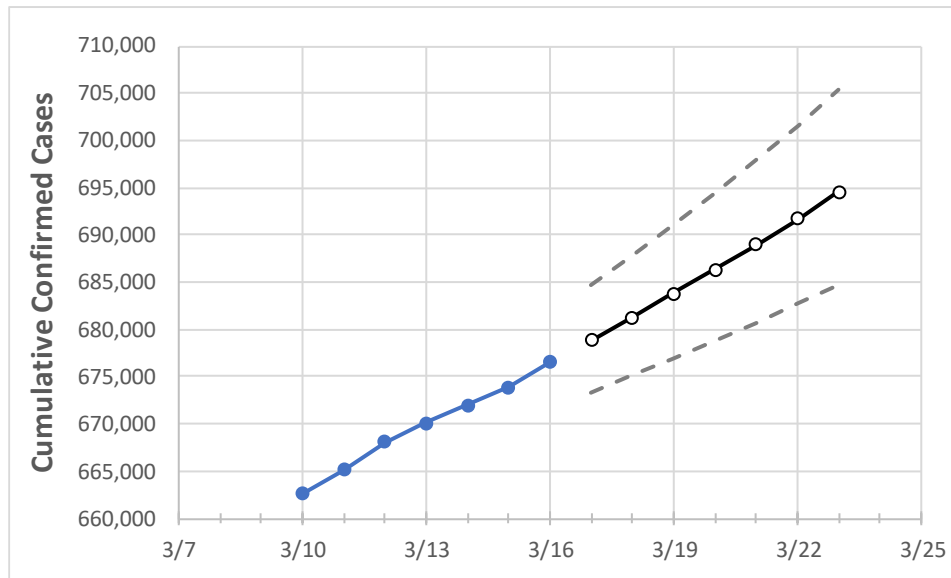
IEM's Modeling Lead

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:						
	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23
Michigan	670,088	672,002	673,916	676,494	678,855	681,289	683,769	686,351	688,999	691,760	694,559

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:						
	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23
Genesee	26,806	26,893	26,979	27,117	27,248	27,386	27,529	27,683	27,836	27,998	28,171
Ingham	17,057	17,154	17,251	17,332	17,405	17,480	17,557	17,636	17,718	17,804	17,890
Kent	53,009	53,094	53,179	53,258	53,355	53,456	53,557	53,660	53,760	53,866	53,973
Livingston	10,813	10,868	10,922	10,958	11,010	11,063	11,119	11,176	11,236	11,297	11,361
Macomb	61,784	62,028	62,272	62,607	62,932	63,261	63,606	63,974	64,352	64,744	65,163
Monroe	10,329	10,354	10,379	10,440	10,491	10,545	10,601	10,658	10,717	10,777	10,840
Oakland	77,604	77,848	78,091	78,465	78,764	79,071	79,384	79,713	80,047	80,403	80,767
Washtenaw	19,261	19,299	19,337	19,402	19,443	19,483	19,524	19,565	19,604	19,643	19,682
Wayne	105,874	106,231	106,587	106,994	107,405	107,837	108,275	108,736	109,213	109,701	110,205

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:											
	3/13	3/14	3/15	3/16	3/18				3/20				3/22			
Genesee	26,806	26,893	26,979	27,117	27,386	(5,477)	[1,315]	{657}	27,683	(5,537)	[1,329]	{664}	27,998	(5,600)	[1,344]	{672}
Ingham	17,057	17,154	17,251	17,332	17,480	(3,496)	[839]	{420}	17,636	(3,527)	[847]	{423}	17,804	(3,561)	[855]	{427}
Kent	53,009	53,094	53,179	53,258	53,456	(10,691)	[2,566]	{1,283}	53,660	(10,732)	[2,576]	{1,288}	53,866	(10,773)	[2,586]	{1,293}
Livingston	10,813	10,868	10,922	10,958	11,063	(2,213)	[531]	{266}	11,176	(2,235)	[536]	{268}	11,297	(2,259)	[542]	{271}
Macomb	61,784	62,028	62,272	62,607	63,261	(12,652)	[3,037]	{1,518}	63,974	(12,795)	[3,071]	{1,535}	64,744	(12,949)	[3,108]	{1,554}
Monroe	10,329	10,354	10,379	10,440	10,545	(2,109)	[506]	{253}	10,658	(2,132)	[512]	{256}	10,777	(2,155)	[517]	{259}
Oakland	77,604	77,848	78,091	78,465	79,071	(15,814)	[3,795]	{1,898}	79,713	(15,943)	[3,826]	{1,913}	80,403	(16,081)	[3,859]	{1,930}
Washtenaw	19,261	19,299	19,337	19,402	19,483	(3,897)	[935]	{468}	19,565	(3,913)	[939]	{470}	19,643	(3,929)	[943]	{471}
Wayne	105,874	106,231	106,587	106,994	107,837	(21,567)	[5,176]	{2,588}	108,736	(21,747)	[5,219]	{2,610}	109,701	(21,940)	[5,266]	{2,633}

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.