

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

Date: 10/18/21

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 10/18/21 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.

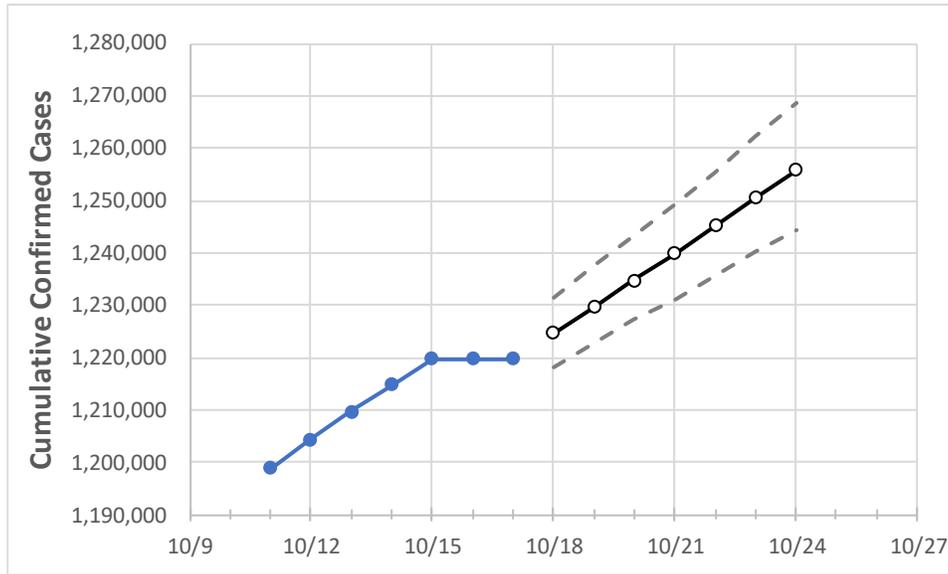
IEM's Modeling Lead

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:							
	10/14	10/15	10/16	10/17	10/18	10/19	10/20	10/21	10/22	10/23	10/24	
Michigan	1,214,721	1,219,715	1,219,715	1,219,715	1,224,675	1,229,664	1,234,735	1,239,890	1,245,164	1,250,514	1,255,816	

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:							
	10/14	10/15	10/16	10/17	10/18	10/19	10/20	10/21	10/22	10/23	10/24	
Genesee	49,906	50,167	50,167	50,167	50,411	50,661	50,917	51,182	51,456	51,737	52,034	
Ingham	29,953	30,047	30,047	30,047	30,152	30,260	30,368	30,474	30,587	30,700	30,812	
Kent	89,633	90,013	90,013	90,013	90,363	90,724	91,083	91,453	91,825	92,203	92,589	
Livingston	21,960	22,092	22,092	22,092	22,237	22,383	22,536	22,687	22,844	23,005	23,169	
Macomb	117,458	117,842	117,842	117,842	118,230	118,622	119,021	119,427	119,831	120,250	120,663	
Monroe	19,530	19,666	19,666	19,666	19,785	19,902	20,023	20,144	20,273	20,398	20,533	
Oakland	141,353	141,782	141,782	141,782	142,212	142,656	143,085	143,538	143,990	144,448	144,899	
Washtenaw	32,223	32,339	32,339	32,339	32,466	32,594	32,727	32,859	32,996	33,132	33,272	
Wayne	193,327	193,928	193,928	193,928	194,508	195,096	195,694	196,305	196,920	197,549	198,172	

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:											
	10/14	10/15	10/16	10/17	10/19			10/21			10/23					
Genesee	49,906	50,167	50,167	50,167	50,661	(10,132)	[2,432]	{1,216}	51,182	(10,236)	[2,457]	{1,228}	51,737	(10,347)	[2,483]	{1,242}
Ingham	29,953	30,047	30,047	30,047	30,260	(6,052)	[1,452]	{726}	30,474	(6,095)	[1,463]	{731}	30,700	(6,140)	[1,474]	{737}
Kent	89,633	90,013	90,013	90,013	90,724	(18,145)	[4,355]	{2,177}	91,453	(18,291)	[4,390]	{2,195}	92,203	(18,441)	[4,426]	{2,213}
Livingston	21,960	22,092	22,092	22,092	22,383	(4,477)	[1,074]	{537}	22,687	(4,537)	[1,089]	{544}	23,005	(4,601)	[1,104]	{552}
Macomb	117,458	117,842	117,842	117,842	118,622	(23,724)	[5,694]	{2,847}	119,427	(23,885)	[5,732]	{2,866}	120,250	(24,050)	[5,772]	{2,886}
Monroe	19,530	19,666	19,666	19,666	19,902	(3,980)	[955]	{478}	20,144	(4,029)	[967]	{483}	20,398	(4,080)	[979]	{490}
Oakland	141,353	141,782	141,782	141,782	142,656	(28,531)	[6,847]	{3,424}	143,538	(28,708)	[6,890]	{3,445}	144,448	(28,890)	[6,933]	{3,467}
Washtenaw	32,223	32,339	32,339	32,339	32,594	(6,519)	[1,565]	{782}	32,859	(6,572)	[1,577]	{789}	33,132	(6,626)	[1,590]	{795}
Wayne	193,327	193,928	193,928	193,928	195,096	(39,019)	[9,365]	{4,682}	196,305	(39,261)	[9,423]	{4,711}	197,549	(39,510)	[9,482]	{4,741}

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.