

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

Date: 10/15/21

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 10/15/21 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.

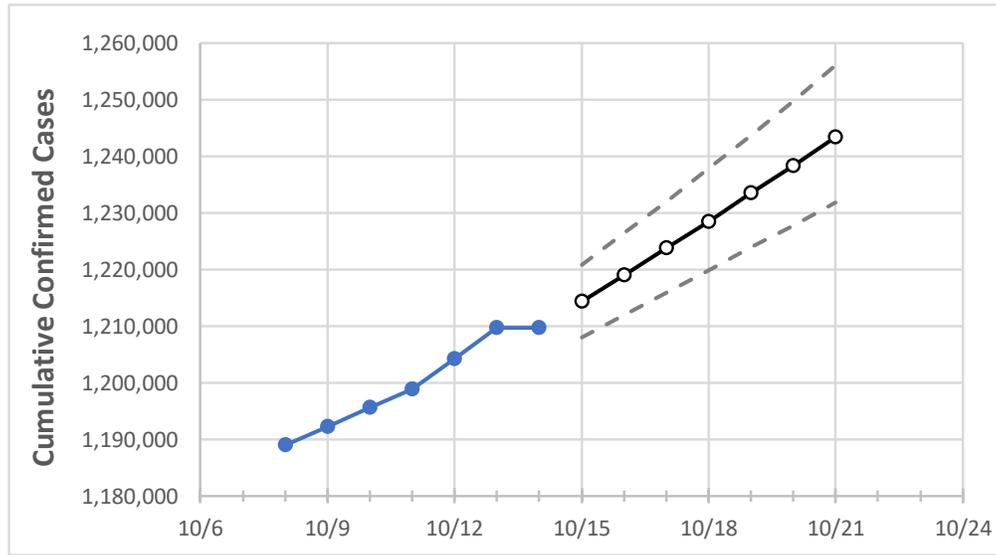
IEM's Modeling Lead

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:					
	10/11	10/12	10/13	10/14	10/15	10/16	10/17	10/18	10/19	10/20	10/21
Michigan	1,198,850	1,204,288	1,209,726	1,209,726	1,214,335	1,219,041	1,223,846	1,228,500	1,233,547	1,238,396	1,243,455

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:						
	10/11	10/12	10/13	10/14	10/15	10/16	10/17	10/18	10/19	10/20	10/21
Genesee	49,156	49,401	49,645	49,645	49,846	50,047	50,255	50,474	50,695	50,923	51,156
Ingham	29,623	29,741	29,858	29,858	29,962	30,068	30,174	30,283	30,392	30,504	30,620
Kent	88,462	88,857	89,252	89,252	89,575	89,898	90,230	90,565	90,902	91,233	91,589
Livingston	21,532	21,680	21,827	21,827	21,966	22,106	22,249	22,396	22,547	22,701	22,859
Macomb	116,312	116,693	117,074	117,074	117,437	117,799	118,171	118,549	118,923	119,308	119,686
Monroe	19,117	19,256	19,394	19,394	19,496	19,598	19,700	19,806	19,913	20,020	20,130
Oakland	139,998	140,461	140,924	140,924	141,340	141,762	142,183	142,610	143,038	143,481	143,902
Washtenaw	31,831	31,969	32,106	32,106	32,229	32,355	32,479	32,608	32,740	32,873	33,008
Wayne	191,603	192,165	192,726	192,726	193,236	193,751	194,274	194,808	195,341	195,891	196,442

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:											
	10/11	10/12	10/13	10/14	10/16				10/18				10/20			
Genesee	49,156	49,401	49,645	49,645	50,047	(10,009)	[2,402]	{1,201}	50,474	(10,095)	[2,423]	{1,211}	50,923	(10,185)	[2,444]	{1,222}
Ingham	29,623	29,741	29,858	29,858	30,068	(6,014)	[1,443]	{722}	30,283	(6,057)	[1,454]	{727}	30,504	(6,101)	[1,464]	{732}
Kent	88,462	88,857	89,252	89,252	89,898	(17,980)	[4,315]	{2,158}	90,565	(18,113)	[4,347]	{2,174}	91,233	(18,247)	[4,379]	{2,190}
Livingston	21,532	21,680	21,827	21,827	22,106	(4,421)	[1,061]	{531}	22,396	(4,479)	[1,075]	{538}	22,701	(4,540)	[1,090]	{545}
Macomb	116,312	116,693	117,074	117,074	117,799	(23,560)	[5,654]	{2,827}	118,549	(23,710)	[5,690]	{2,845}	119,308	(23,862)	[5,727]	{2,863}
Monroe	19,117	19,256	19,394	19,394	19,598	(3,920)	[941]	{470}	19,806	(3,961)	[951]	{475}	20,020	(4,004)	[961]	{480}
Oakland	139,998	140,461	140,924	140,924	141,762	(28,352)	[6,805]	{3,402}	142,610	(28,522)	[6,845]	{3,423}	143,481	(28,696)	[6,887]	{3,444}
Washtenaw	31,831	31,969	32,106	32,106	32,355	(6,471)	[1,553]	{777}	32,608	(6,522)	[1,565]	{783}	32,873	(6,575)	[1,578]	{789}
Wayne	191,603	192,165	192,726	192,726	193,751	(38,750)	[9,300]	{4,650}	194,808	(38,962)	[9,351]	{4,675}	195,891	(39,178)	[9,403]	{4,701}

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.