

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 12/13/21**

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 12/13/21 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.

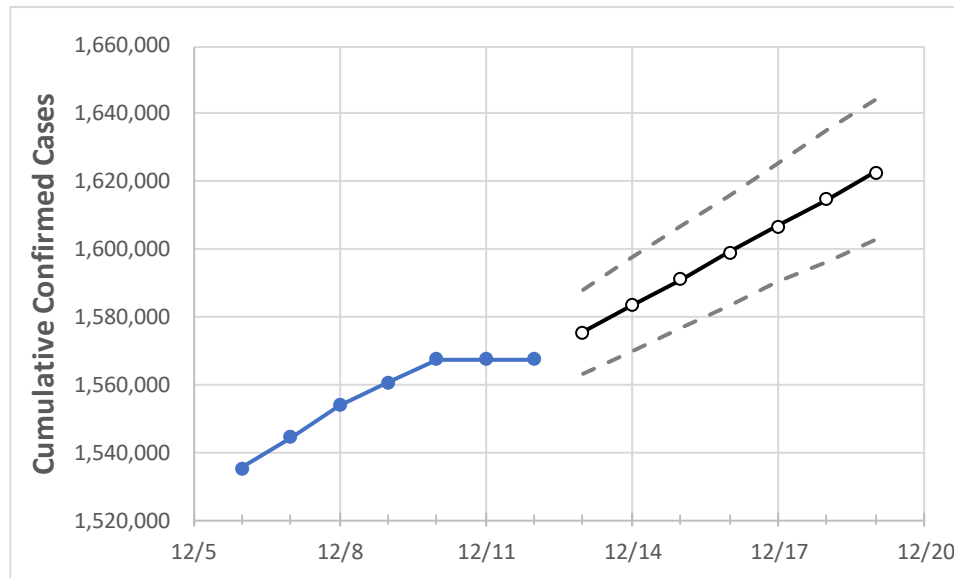
IEM's Modeling Lead

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:						
	12/9	12/10	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19
Michigan	1,560,684	1,567,578	1,567,578	1,567,578	1,575,353	1,583,301	1,591,004	1,598,949	1,606,848	1,614,839	1,622,688

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:						
	12/9	12/10	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19
Genesee	65,743	66,135	66,135	66,135	66,584	67,029	67,472	67,929	68,388	68,848	69,308
Ingham	38,551	38,696	38,696	38,696	38,873	39,049	39,226	39,403	39,583	39,764	39,938
Kent	114,696	115,118	115,118	115,118	115,568	116,025	116,460	116,905	117,336	117,773	118,199
Livingston	30,426	30,602	30,602	30,602	30,779	30,951	31,122	31,295	31,467	31,639	31,810
Macomb	148,434	149,089	149,089	149,089	149,868	150,657	151,421	152,229	153,028	153,817	154,605
Monroe	25,050	25,138	25,138	25,138	25,255	25,366	25,478	25,596	25,708	25,824	25,938
Oakland	178,232	179,078	179,078	179,078	180,058	181,028	181,957	182,931	183,925	184,913	185,870
Washtenaw	40,992	41,185	41,185	41,185	41,416	41,644	41,879	42,112	42,347	42,585	42,820
Wayne	241,476	242,555	242,555	242,555	243,836	245,137	246,396	247,707	249,009	250,319	251,662

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:											
	12/9	12/10	12/11	12/12	12/14			12/16			12/18					
Genesee	65,743	66,135	66,135	66,135	67,029	(13,406)	[3,217]	{1,609}	67,929	(13,586)	[3,261]	{1,630}	68,848	(13,770)	[3,305]	{1,652}
Ingham	38,551	38,696	38,696	38,696	39,049	(7,810)	[1,874]	{937}	39,403	(7,881)	[1,891]	{946}	39,764	(7,953)	[1,909]	{954}
Kent	114,696	115,118	115,118	115,118	116,025	(23,205)	[5,569]	{2,785}	116,905	(23,381)	[5,611]	{2,806}	117,773	(23,555)	[5,653]	{2,827}
Livingston	30,426	30,602	30,602	30,602	30,951	(6,190)	[1,486]	{743}	31,295	(6,259)	[1,502]	{751}	31,639	(6,328)	[1,519]	{759}
Macomb	148,434	149,089	149,089	149,089	150,657	(30,131)	[7,232]	{3,616}	152,229	(30,446)	[7,307]	{3,653}	153,817	(30,763)	[7,383]	{3,692}
Monroe	25,050	25,138	25,138	25,138	25,366	(5,073)	[1,218]	{609}	25,596	(5,119)	[1,229]	{614}	25,824	(5,165)	[1,240]	{620}
Oakland	178,232	179,078	179,078	179,078	181,028	(36,206)	[8,689]	{4,345}	182,931	(36,586)	[8,781]	{4,390}	184,913	(36,983)	[8,876]	{4,438}
Washtenaw	40,992	41,185	41,185	41,185	41,644	(8,329)	[1,999]	{999}	42,112	(8,422)	[2,021]	{1,011}	42,585	(8,517)	[2,044]	{1,022}
Wayne	241,476	242,555	242,555	242,555	245,137	(49,027)	[11,767]	{5,883}	247,707	(49,541)	[11,890]	{5,945}	250,319	(50,064)	[12,015]	{6,008}

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.