

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

Date: 9/22/21

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 9/22/21 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.

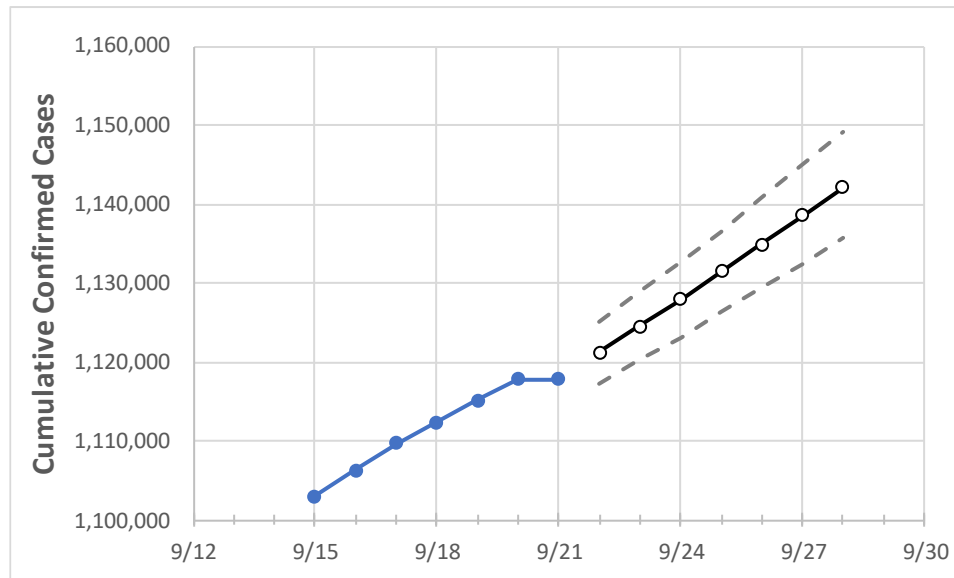
IEM's Modeling Lead

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:						
	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28
Michigan	1,112,377	1,115,112	1,117,846	1,117,846	1,121,179	1,124,549	1,127,971	1,131,445	1,134,928	1,138,544	1,142,175

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:						
	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28
Genesee	46,171	46,251	46,330	46,330	46,449	46,570	46,689	46,812	46,937	47,061	47,186
Ingham	27,642	27,732	27,822	27,822	27,914	28,006	28,101	28,199	28,297	28,401	28,506
Kent	82,120	82,344	82,568	82,568	82,840	83,119	83,395	83,682	83,973	84,266	84,565
Livingston	19,379	19,433	19,487	19,487	19,549	19,610	19,670	19,732	19,794	19,856	19,918
Macomb	109,344	109,559	109,774	109,774	110,012	110,254	110,493	110,737	110,985	111,237	111,487
Monroe	17,270	17,333	17,395	17,395	17,464	17,530	17,598	17,670	17,742	17,819	17,896
Oakland	131,766	132,009	132,253	132,253	132,541	132,835	133,122	133,418	133,715	134,014	134,316
Washtenaw	29,746	29,810	29,874	29,874	29,952	30,029	30,106	30,184	30,260	30,341	30,420
Wayne	182,044	182,329	182,613	182,613	182,971	183,331	183,681	184,041	184,405	184,772	185,134

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:											
	9/18	9/19	9/20	9/21	9/23				9/25				9/27			
Genesee	46,171	46,251	46,330	46,330	46,570	(9,314)	[2,235]	{1,118}	46,812	(9,362)	[2,247]	{1,123}	47,061	(9,412)	[2,259]	{1,129}
Ingham	27,642	27,732	27,822	27,822	28,006	(5,601)	[1,344]	{672}	28,199	(5,640)	[1,354]	{677}	28,401	(5,680)	[1,363]	{682}
Kent	82,120	82,344	82,568	82,568	83,119	(16,624)	[3,990]	{1,995}	83,682	(16,736)	[4,017]	{2,008}	84,266	(16,853)	[4,045]	{2,022}
Livingston	19,379	19,433	19,487	19,487	19,610	(3,922)	[941]	{471}	19,732	(3,946)	[947]	{474}	19,856	(3,971)	[953]	{477}
Macomb	109,344	109,559	109,774	109,774	110,254	(22,051)	[5,292]	{2,646}	110,737	(22,147)	[5,315]	{2,658}	111,237	(22,247)	[5,339]	{2,670}
Monroe	17,270	17,333	17,395	17,395	17,530	(3,506)	[841]	{421}	17,670	(3,534)	[848]	{424}	17,819	(3,564)	[855]	{428}
Oakland	131,766	132,009	132,253	132,253	132,835	(26,567)	[6,376]	{3,188}	133,418	(26,684)	[6,404]	{3,202}	134,014	(26,803)	[6,433]	{3,216}
Washtenaw	29,746	29,810	29,874	29,874	30,029	(6,006)	[1,441]	{721}	30,184	(6,037)	[1,449]	{724}	30,341	(6,068)	[1,456]	{728}
Wayne	182,044	182,329	182,613	182,613	183,331	(36,666)	[8,800]	{4,400}	184,041	(36,808)	[8,834]	{4,417}	184,772	(36,954)	[8,869]	{4,435}

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.