

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 11/3/21**

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 11/3/21 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.

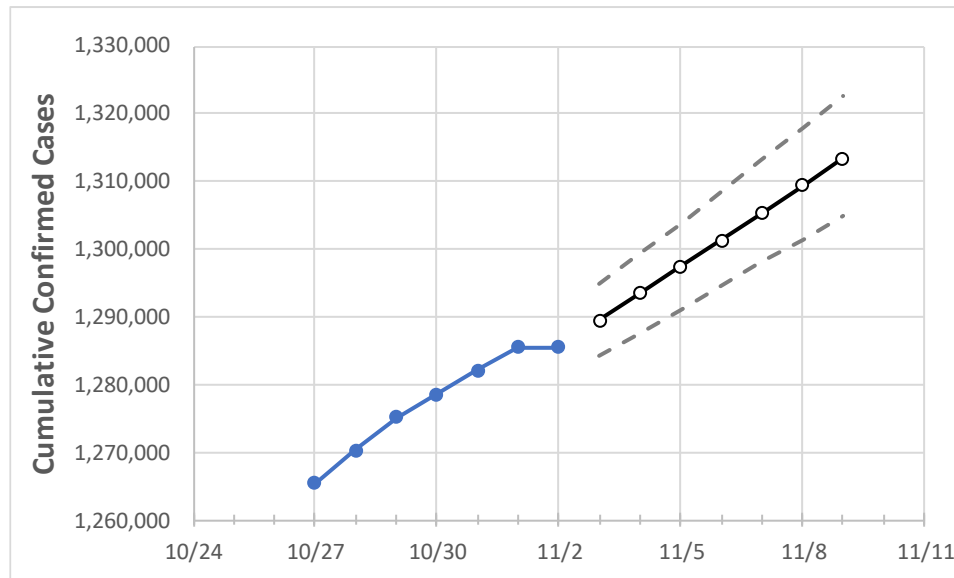
IEM's Modeling Lead

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:							
	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7	11/8	11/9	
Michigan	1,278,575	1,282,046	1,285,518	1,285,518	1,289,464	1,293,510	1,297,439	1,301,328	1,305,343	1,309,372	1,313,356	

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:							
	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7	11/8	11/9	
Genesee	52,816	52,981	53,145	53,145	53,332	53,517	53,701	53,887	54,073	54,265	54,447	
Ingham	31,371	31,446	31,521	31,521	31,613	31,705	31,792	31,884	31,978	32,070	32,162	
Kent	94,570	94,816	95,061	95,061	95,362	95,659	95,950	96,242	96,539	96,838	97,131	
Livingston	23,477	23,552	23,628	23,628	23,714	23,797	23,881	23,965	24,048	24,129	24,211	
Macomb	122,627	123,000	123,374	123,374	123,754	124,142	124,534	124,935	125,339	125,743	126,150	
Monroe	20,800	20,852	20,905	20,905	20,976	21,048	21,119	21,191	21,260	21,333	21,403	
Oakland	147,279	147,616	147,952	147,952	148,332	148,705	149,093	149,471	149,852	150,239	150,616	
Washtenaw	33,609	33,690	33,770	33,770	33,854	33,938	34,020	34,102	34,185	34,268	34,349	
Wayne	200,931	201,371	201,812	201,812	202,301	202,795	203,272	203,768	204,261	204,762	205,251	

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:											
	10/30	10/31	11/1	11/2	11/4			11/6			11/8					
Genesee	52,816	52,981	53,145	53,145	53,517	(10,703)	[2,569]	{1,284}	53,887	(10,777)	[2,587]	{1,293}	54,265	(10,853)	[2,605]	{1,302}
Ingham	31,371	31,446	31,521	31,521	31,705	(6,341)	[1,522]	{761}	31,884	(6,377)	[1,530]	{765}	32,070	(6,414)	[1,539]	{770}
Kent	94,570	94,816	95,061	95,061	95,659	(19,132)	[4,592]	{2,296}	96,242	(19,248)	[4,620]	{2,310}	96,838	(19,368)	[4,648]	{2,324}
Livingston	23,477	23,552	23,628	23,628	23,797	(4,759)	[1,142]	{571}	23,965	(4,793)	[1,150]	{575}	24,129	(4,826)	[1,158]	{579}
Macomb	122,627	123,000	123,374	123,374	124,142	(24,828)	[5,959]	{2,979}	124,935	(24,987)	[5,997]	{2,998}	125,743	(25,149)	[6,036]	{3,018}
Monroe	20,800	20,852	20,905	20,905	21,048	(4,210)	[1,010]	{505}	21,191	(4,238)	[1,017]	{509}	21,333	(4,267)	[1,024]	{512}
Oakland	147,279	147,616	147,952	147,952	148,705	(29,741)	[7,138]	{3,569}	149,471	(29,894)	[7,175]	{3,587}	150,239	(30,048)	[7,211]	{3,606}
Washtenaw	33,609	33,690	33,770	33,770	33,938	(6,788)	[1,629]	{815}	34,102	(6,820)	[1,637]	{818}	34,268	(6,854)	[1,645]	{822}
Wayne	200,931	201,371	201,812	201,812	202,795	(40,559)	[9,734]	{4,867}	203,768	(40,754)	[9,781]	{4,890}	204,762	(40,952)	[9,829]	{4,914}

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.