

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

Date: 1/28/21

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 1/28/21 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.**

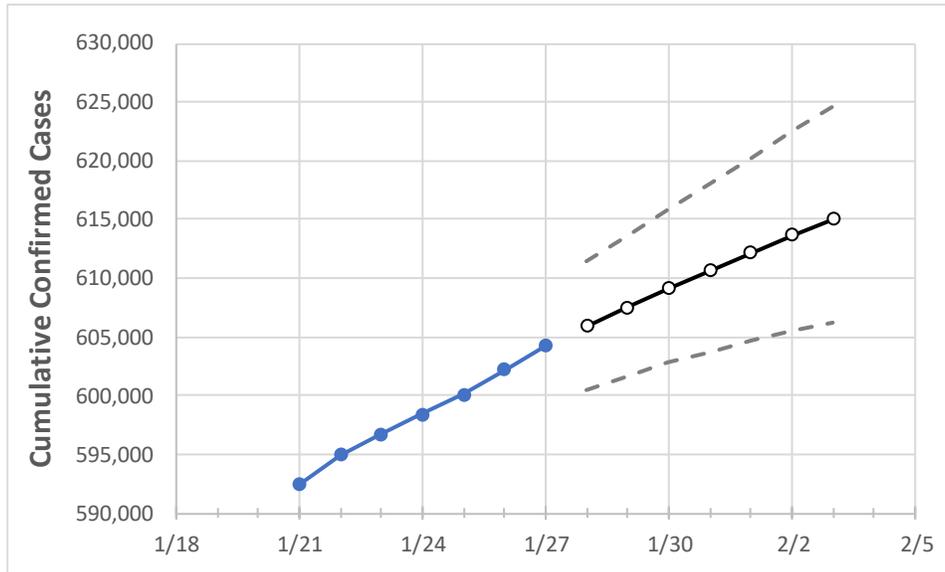
### IEM's Modeling Lead

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:							
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3	
Michigan	598,420	600,093	602,168	604,233	605,883	607,537	609,101	610,676	612,186	613,646	615,015	

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:							
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3	
Genesee	24,038	24,094	24,150	24,198	24,248	24,297	24,343	24,385	24,426	24,466	24,503	
Ingham	14,581	14,628	14,724	14,796	14,859	14,921	14,983	15,042	15,103	15,159	15,217	
Kent	48,450	48,579	48,738	48,900	49,021	49,136	49,253	49,362	49,469	49,570	49,669	
Livingston	9,329	9,366	9,417	9,466	9,506	9,545	9,584	9,622	9,659	9,695	9,729	
Macomb	54,877	54,990	55,228	55,390	55,552	55,711	55,866	56,018	56,166	56,314	56,456	
Monroe	8,934	8,959	9,004	9,044	9,077	9,109	9,140	9,170	9,199	9,227	9,254	
Oakland	69,122	69,285	69,558	69,772	69,950	70,123	70,288	70,445	70,605	70,752	70,895	
Washtenaw	15,992	16,051	16,193	16,295	16,368	16,441	16,514	16,586	16,655	16,725	16,793	
Wayne	94,935	95,180	95,548	95,847	96,111	96,367	96,619	96,865	97,106	97,335	97,564	

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:											
	1/24	1/25	1/26	1/27	1/29				1/31				2/2			
Genesee	24,038	24,094	24,150	24,198	24,297	(4,859)	[1,166]	{583}	24,385	(4,877)	[1,171]	{585}	24,466	(4,893)	[1,174]	{587}
Ingham	14,581	14,628	14,724	14,796	14,921	(2,984)	[716]	{358}	15,042	(3,008)	[722]	{361}	15,159	(3,032)	[728]	{364}
Kent	48,450	48,579	48,738	48,900	49,136	(9,827)	[2,359]	{1,179}	49,362	(9,872)	[2,369]	{1,185}	49,570	(9,914)	[2,379]	{1,190}
Livingston	9,329	9,366	9,417	9,466	9,545	(1,909)	[458]	{229}	9,622	(1,924)	[462]	{231}	9,695	(1,939)	[465]	{233}
Macomb	54,877	54,990	55,228	55,390	55,711	(11,142)	[2,674]	{1,337}	56,018	(11,204)	[2,689]	{1,344}	56,314	(11,263)	[2,703]	{1,352}
Monroe	8,934	8,959	9,004	9,044	9,109	(1,822)	[437]	{219}	9,170	(1,834)	[440]	{220}	9,227	(1,845)	[443]	{221}
Oakland	69,122	69,285	69,558	69,772	70,123	(14,025)	[3,366]	{1,683}	70,445	(14,089)	[3,381]	{1,691}	70,752	(14,150)	[3,396]	{1,698}
Washtenaw	15,992	16,051	16,193	16,295	16,441	(3,288)	[789]	{395}	16,586	(3,317)	[796]	{398}	16,725	(3,345)	[803]	{401}
Wayne	94,935	95,180	95,548	95,847	96,367	(19,273)	[4,626]	{2,313}	96,865	(19,373)	[4,650]	{2,325}	97,335	(19,467)	[4,672]	{2,336}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at [bryan.koon@iem.com](mailto:bryan.koon@iem.com) or 850-519-7966 or Stephanie Tennyson at [stephanie.tennyson@iem.com](mailto:stephanie.tennyson@iem.com) or 202-309-4257.