

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

Date: 5/6/21

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 5/6/21 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.

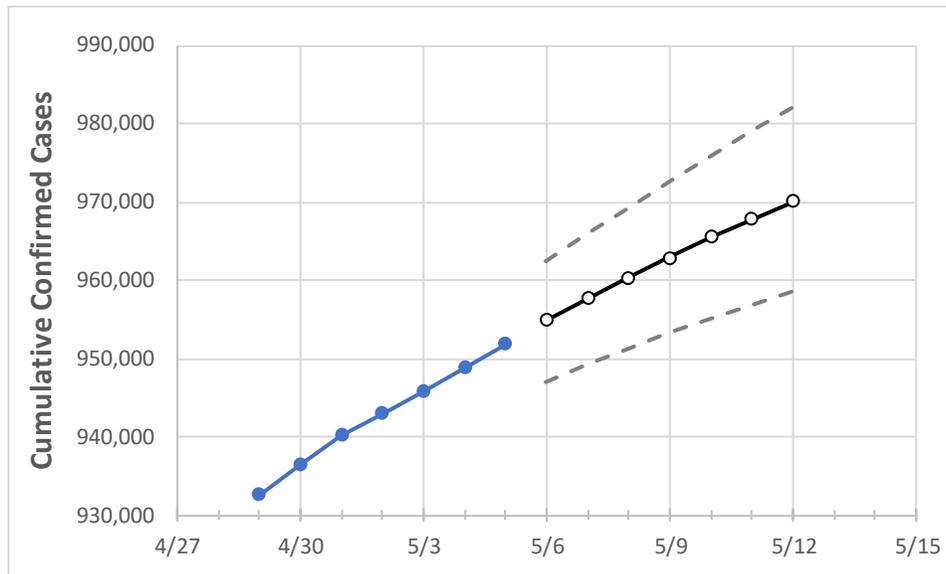
IEM's Modeling Lead

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:							
	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10	5/11	5/12	
Michigan	942,954	945,732	948,852	951,899	954,842	957,684	960,373	962,910	965,478	967,842	970,094	

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:							
	5/2	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10	5/11	5/12	
Genesee	39,870	40,007	40,138	40,220	40,353	40,481	40,603	40,722	40,834	40,943	41,045	
Ingham	23,756	23,803	23,876	23,917	23,967	24,013	24,057	24,099	24,139	24,176	24,211	
Kent	68,694	68,950	69,152	69,365	69,602	69,825	70,042	70,253	70,454	70,652	70,852	
Livingston	15,923	15,970	16,010	16,057	16,108	16,157	16,203	16,248	16,290	16,332	16,372	
Macomb	95,261	95,546	95,874	96,167	96,439	96,702	96,950	97,183	97,412	97,622	97,821	
Monroe	14,619	14,663	14,730	14,764	14,807	14,848	14,887	14,925	14,961	14,994	15,029	
Oakland	111,684	111,939	112,263	112,680	113,017	113,347	113,657	113,957	114,251	114,533	114,806	
Washtenaw	25,498	25,546	25,592	25,655	25,704	25,752	25,796	25,839	25,879	25,917	25,950	
Wayne	155,991	156,564	157,029	157,553	158,065	158,563	159,031	159,484	159,913	160,325	160,717	

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:											
	5/2	5/3	5/4	5/5	5/7			5/9			5/11					
Genesee	39,870	40,007	40,138	40,220	40,481	(8,096)	[1,943]	{972}	40,722	(8,144)	[1,955]	{977}	40,943	(8,189)	[1,965]	{983}
Ingham	23,756	23,803	23,876	23,917	24,013	(4,803)	[1,153]	{576}	24,099	(4,820)	[1,157]	{578}	24,176	(4,835)	[1,160]	{580}
Kent	68,694	68,950	69,152	69,365	69,825	(13,965)	[3,352]	{1,676}	70,253	(14,051)	[3,372]	{1,686}	70,652	(14,130)	[3,391]	{1,696}
Livingston	15,923	15,970	16,010	16,057	16,157	(3,231)	[776]	{388}	16,248	(3,250)	[780]	{390}	16,332	(3,266)	[784]	{392}
Macomb	95,261	95,546	95,874	96,167	96,702	(19,340)	[4,642]	{2,321}	97,183	(19,437)	[4,665]	{2,332}	97,622	(19,524)	[4,686]	{2,343}
Monroe	14,619	14,663	14,730	14,764	14,848	(2,970)	[713]	{356}	14,925	(2,985)	[716]	{358}	14,994	(2,999)	[720]	{360}
Oakland	111,684	111,939	112,263	112,680	113,347	(22,669)	[5,441]	{2,720}	113,957	(22,791)	[5,470]	{2,735}	114,533	(22,907)	[5,498]	{2,749}
Washtenaw	25,498	25,546	25,592	25,655	25,752	(5,150)	[1,236]	{618}	25,839	(5,168)	[1,240]	{620}	25,917	(5,183)	[1,244]	{622}
Wayne	155,991	156,564	157,029	157,553	158,563	(31,713)	[7,611]	{3,806}	159,484	(31,897)	[7,655]	{3,828}	160,325	(32,065)	[7,696]	{3,848}

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.