

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

Date: 5/7/21

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 5/7/21 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.

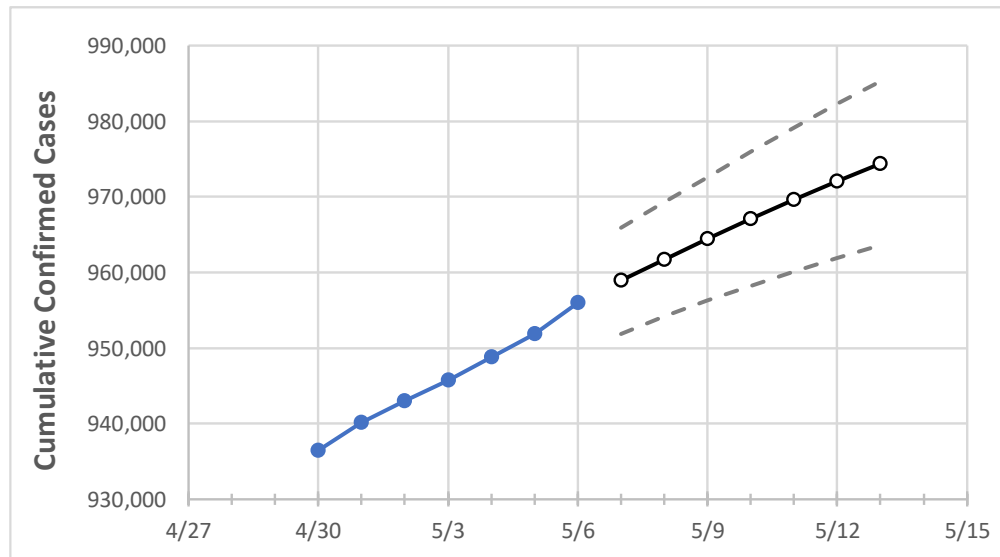
IEM's Modeling Lead

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:						
	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10	5/11	5/12	5/13
Michigan	945,732	948,852	951,899	956,012	958,958	961,734	964,416	967,076	969,630	972,060	974,347

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:						
	5/3	5/4	5/5	5/6	5/7	5/8	5/9	5/10	5/11	5/12	5/13
Genesee	40,007	40,138	40,220	40,376	40,500	40,622	40,735	40,847	40,950	41,050	41,147
Ingham	23,803	23,876	23,917	23,989	24,039	24,087	24,133	24,177	24,218	24,256	24,294
Kent	68,950	69,152	69,365	69,629	69,860	70,088	70,308	70,521	70,730	70,932	71,128
Livingston	15,970	16,010	16,057	16,116	16,165	16,211	16,255	16,298	16,338	16,376	16,412
Macomb	95,546	95,874	96,167	96,540	96,814	97,079	97,335	97,585	97,825	98,050	98,269
Monroe	14,663	14,730	14,764	14,826	14,870	14,913	14,954	14,994	15,034	15,072	15,108
Oakland	111,939	112,263	112,680	113,204	113,544	113,874	114,190	114,496	114,792	115,074	115,343
Washtenaw	25,546	25,592	25,655	25,739	25,788	25,835	25,878	25,919	25,959	25,997	26,033
Wayne	156,564	157,029	157,553	158,230	158,744	159,240	159,726	160,165	160,601	161,012	161,415

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:											
	5/3	5/4	5/5	5/6	5/8			5/10			5/12					
Genesee	40,007	40,138	40,220	40,376	40,622	(8,124)	[1,950]	{975}	40,847	(8,169)	[1,961]	{980}	41,050	(8,210)	[1,970]	{985}
Ingham	23,803	23,876	23,917	23,989	24,087	(4,817)	[1,156]	{578}	24,177	(4,835)	[1,161]	{580}	24,256	(4,851)	[1,164]	{582}
Kent	68,950	69,152	69,365	69,629	70,088	(14,018)	[3,364]	{1,682}	70,521	(14,104)	[3,385]	{1,693}	70,932	(14,186)	[3,405]	{1,702}
Livingston	15,970	16,010	16,057	16,116	16,211	(3,242)	[778]	{389}	16,298	(3,260)	[782]	{391}	16,376	(3,275)	[786]	{393}
Macomb	95,546	95,874	96,167	96,540	97,079	(19,416)	[4,660]	{2,330}	97,585	(19,517)	[4,684]	{2,342}	98,050	(19,610)	[4,706]	{2,353}
Monroe	14,663	14,730	14,764	14,826	14,913	(2,983)	[716]	{358}	14,994	(2,999)	[720]	{360}	15,072	(3,014)	[723]	{362}
Oakland	111,939	112,263	112,680	113,204	113,874	(22,775)	[5,466]	{2,733}	114,496	(22,899)	[5,496]	{2,748}	115,074	(23,015)	[5,524]	{2,762}
Washtenaw	25,546	25,592	25,655	25,739	25,835	(5,167)	[1,240]	{620}	25,919	(5,184)	[1,244]	{622}	25,997	(5,199)	[1,248]	{624}
Wayne	156,564	157,029	157,553	158,230	159,240	(31,848)	[7,644]	{3,822}	160,165	(32,033)	[7,688]	{3,844}	161,012	(32,202)	[7,729]	{3,864}

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.