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

Date: 10/6/21

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 10/6/21 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.

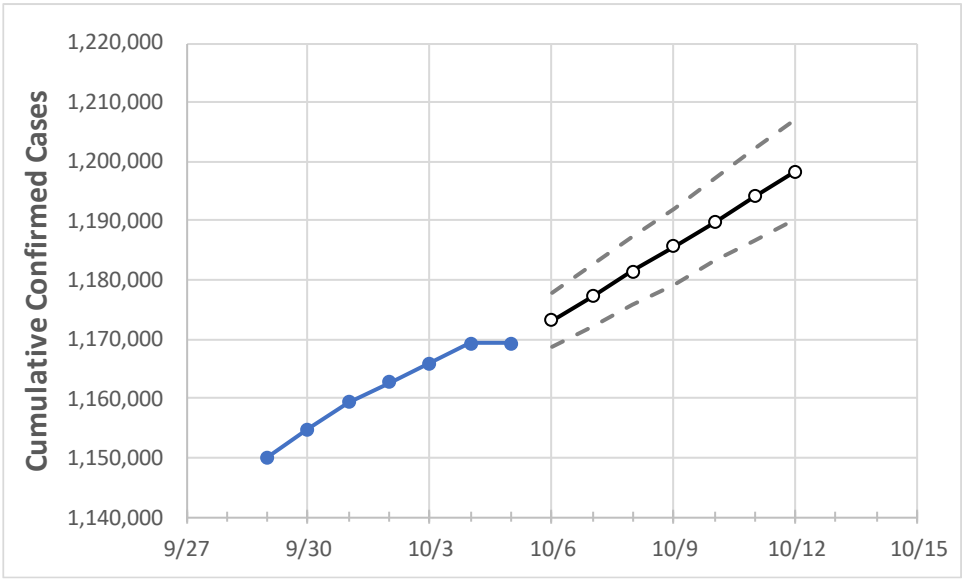
IEM's Modeling Lead

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:						
	10/2	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12
Michigan	1,162,692	1,165,965	1,169,238	1,169,238	1,173,248	1,177,321	1,181,395	1,185,628	1,189,778	1,194,073	1,198,376

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:						
	10/2	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12
Genesee	47,809	47,909	48,009	48,009	48,147	48,291	48,438	48,586	48,737	48,893	49,049
Ingham	28,806	28,885	28,963	28,963	29,049	29,135	29,222	29,311	29,400	29,489	29,580
Kent	85,918	86,159	86,401	86,401	86,691	86,976	87,262	87,553	87,846	88,144	88,440
Livingston	20,538	20,621	20,704	20,704	20,808	20,913	21,021	21,129	21,240	21,356	21,473
Macomb	113,398	113,666	113,933	113,933	114,271	114,610	114,954	115,309	115,668	116,036	116,410
Monroe	18,374	18,433	18,492	18,492	18,588	18,688	18,791	18,896	19,001	19,113	19,228
Oakland	136,612	136,908	137,205	137,205	137,583	137,968	138,355	138,745	139,145	139,555	139,961
Washtenaw	30,908	31,000	31,091	31,091	31,187	31,282	31,382	31,482	31,583	31,686	31,788
Wayne	187,549	187,938	188,328	188,328	188,774	189,232	189,692	190,153	190,624	191,105	191,592

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:											
	10/2	10/3	10/4	10/5	10/7				10/9				10/11			
Genesee	47,809	47,909	48,009	48,009	48,291	(9,658)	[2,318]	{1,159}	48,586	(9,717)	[2,332]	{1,166}	48,893	(9,779)	[2,347]	{1,173}
Ingham	28,806	28,885	28,963	28,963	29,135	(5,827)	[1,398]	{699}	29,311	(5,862)	[1,407]	{703}	29,489	(5,898)	[1,415]	{708}
Kent	85,918	86,159	86,401	86,401	86,976	(17,395)	[4,175]	{2,087}	87,553	(17,511)	[4,203]	{2,101}	88,144	(17,629)	[4,231]	{2,115}
Livingston	20,538	20,621	20,704	20,704	20,913	(4,183)	[1,004]	{502}	21,129	(4,226)	[1,014]	{507}	21,356	(4,271)	[1,025]	{513}
Macomb	113,398	113,666	113,933	113,933	114,610	(22,922)	[5,501]	{2,751}	115,309	(23,062)	[5,535]	{2,767}	116,036	(23,207)	[5,570]	{2,785}
Monroe	18,374	18,433	18,492	18,492	18,688	(3,738)	[897]	{449}	18,896	(3,779)	[907]	{454}	19,113	(3,823)	[917]	{459}
Oakland	136,612	136,908	137,205	137,205	137,968	(27,594)	[6,622]	{3,311}	138,745	(27,749)	[6,660]	{3,330}	139,555	(27,911)	[6,699]	{3,349}
Washtenaw	30,908	31,000	31,091	31,091	31,282	(6,256)	[1,502]	{751}	31,482	(6,296)	[1,511]	{756}	31,686	(6,337)	[1,521]	{760}
Wayne	187,549	187,938	188,328	188,328	189,232	(37,846)	[9,083]	{4,542}	190,153	(38,031)	[9,127]	{4,564}	191,105	(38,221)	[9,173]	{4,587}

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.