IEM's AI Modeling: Short-term COVID-19 Projections
Date: 2/12/21

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 <u>not</u> 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 2/12/21 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
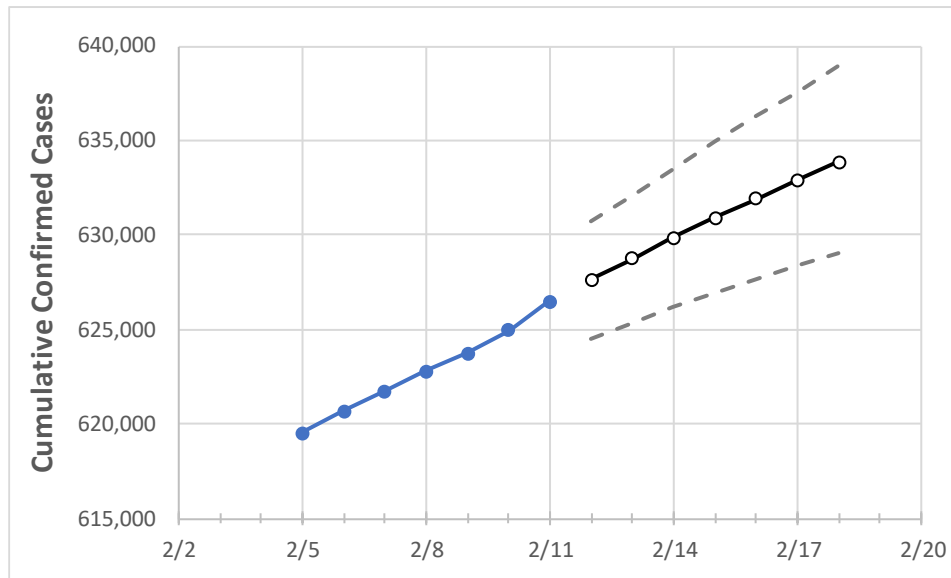
	Actual Confirmed Cases On:				Projected Cases For:						
	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17	2/18
Michigan	622,813	623,731	624,970	626,477	627,637	628,753	629,836	630,910	631,912	632,908	633,874

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:						
	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17	2/18
Genesee	24,720	24,732	24,776	24,815	24,844	24,873	24,900	24,927	24,952	24,977	25,001
Ingham	15,588	15,616	15,684	15,736	15,793	15,851	15,906	15,961	16,016	16,070	16,124
Kent	50,094	50,158	50,273	50,413	50,495	50,573	50,650	50,722	50,796	50,868	50,938
Livingston	9,874	9,892	9,918	9,938	9,963	9,988	10,011	10,033	10,055	10,076	10,097
Macomb	56,893	56,964	57,089	57,222	57,321	57,418	57,510	57,603	57,690	57,777	57,860
Monroe	9,384	9,405	9,423	9,464	9,486	9,506	9,526	9,546	9,565	9,583	9,601
Oakland	72,077	72,246	72,411	72,577	72,734	72,885	73,037	73,185	73,328	73,469	73,602
Washtenaw	17,439	17,526	17,581	17,681	17,759	17,837	17,913	17,988	18,064	18,137	18,209
Wayne	98,524	98,632	98,783	98,971	99,127	99,279	99,430	99,573	99,710	99,846	99,975

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:		
	2/8	2/9	2/10	2/11	2/13	2/15	2/17
Genesee	24,720	24,732	24,776	24,815	24,873 (4,975) [1,194] {597}	24,927 (4,985) [1,196] {598}	24,977 (4,995) [1,199] {599}
Ingham	15,588	15,616	15,684	15,736	15,851 (3,170) [761] {380}	15,961 (3,192) [766] {383}	16,070 (3,214) [771] {386}
Kent	50,094	50,158	50,273	50,413	50,573 (10,115) [2,428] {1,214}	50,722 (10,144) [2,435] {1,217}	50,868 (10,174) [2,442] {1,221}
Livingston	9,874	9,892	9,918	9,938	9,988 (1,998) [479] {240}	10,033 (2,007) [482] {241}	10,076 (2,015) [484] {242}
Macomb	56,893	56,964	57,089	57,222	57,418 (11,484) [2,756] {1,378}	57,603 (11,521) [2,765] {1,382}	57,777 (11,555) [2,773] {1,387}
Monroe	9,384	9,405	9,423	9,464	9,506 (1,901) [456] {228}	9,546 (1,909) [458] {229}	9,583 (1,917) [460] {230}
Oakland	72,077	72,246	72,411	72,577	72,885 (14,577) [3,498] {1,749}	73,185 (14,637) [3,513] {1,756}	73,469 (14,694) [3,526] {1,763}
Washtenaw	17,439	17,526	17,581	17,681	17,837 (3,567) [856] {428}	17,988 (3,598) [863] {432}	18,137 (3,627) [871] {435}
Wayne	98,524	98,632	98,783	98,971	99,279 (19,856) [4,765] {2,383}	99,573 (19,915) [4,779] {2,390}	99,846 (19,969) [4,793] {2,396}

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.