IEM's AI Modeling: Short-term COVID-19 Projections
Date: 3/2/22

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 3/2/22 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
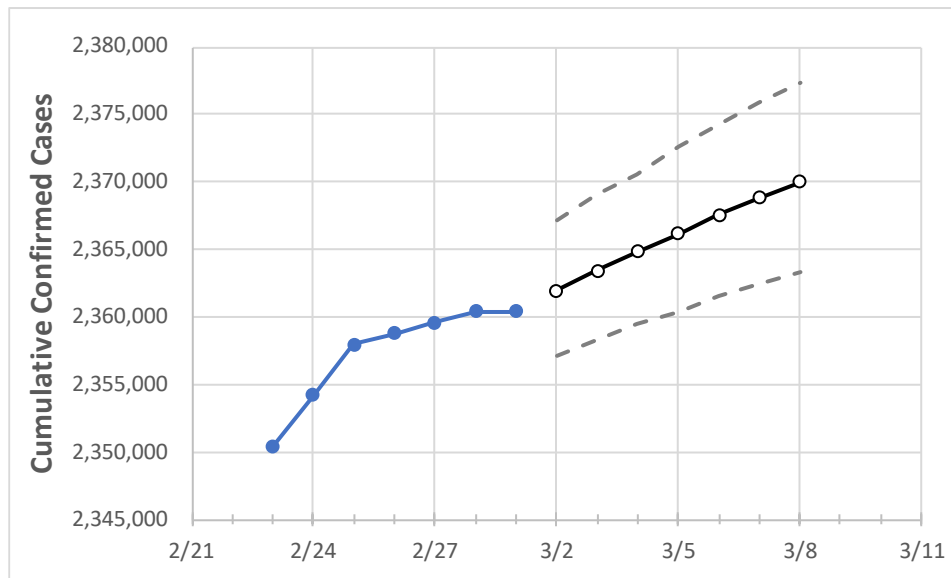
	Actual Confirmed Cases On:				Projected Cases For:						
	2/26	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8
Michigan	2,358,770	2,359,584	2,360,399	2,360,399	2,361,990	2,363,437	2,364,820	2,366,185	2,367,537	2,368,839	2,370,007

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:						
	2/26	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8
Genesee	99,993	100,015	100,036	100,036	100,090	100,134	100,188	100,228	100,276	100,319	100,358
Ingham	63,014	63,048	63,083	63,083	63,124	63,167	63,204	63,245	63,283	63,319	63,354
Kent	164,854	164,897	164,941	164,941	165,057	165,147	165,256	165,346	165,438	165,531	165,624
Livingston	45,294	45,307	45,321	45,321	45,352	45,380	45,407	45,435	45,462	45,485	45,510
Macomb	224,480	224,574	224,669	224,669	224,795	224,912	225,023	225,142	225,250	225,362	225,462
Monroe	37,522	37,533	37,544	37,544	37,558	37,571	37,583	37,595	37,606	37,616	37,626
Oakland	281,917	281,998	282,079	282,079	282,232	282,383	282,532	282,669	282,809	282,944	283,072
Washtenaw	72,821	72,868	72,915	72,915	73,009	73,097	73,188	73,265	73,349	73,432	73,513
Wayne	392,504	392,588	392,673	392,673	392,834	393,009	393,172	393,335	393,475	393,634	393,781

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:		
	2/26	2/27	2/28	3/1	3/3	3/5	3/7
Genesee	99,993	100,015	100,036	100,036	100,134 (20,027) [4,806] {2,403}	100,228 (20,046) [4,811] {2,405}	100,319 (20,064) [4,815] {2,408}
Ingham	63,014	63,048	63,083	63,083	63,167 (12,633) [3,032] {1,516}	63,245 (12,649) [3,036] {1,518}	63,319 (12,664) [3,039] {1,520}
Kent	164,854	164,897	164,941	164,941	165,147 (33,029) [7,927] {3,964}	165,346 (33,069) [7,937] {3,968}	165,531 (33,106) [7,945] {3,973}
Livingston	45,294	45,307	45,321	45,321	45,380 (9,076) [2,178] {1,089}	45,435 (9,087) [2,181] {1,090}	45,485 (9,097) [2,183] {1,092}
Macomb	224,480	224,574	224,669	224,669	224,912 (44,982) [10,796] {5,398}	225,142 (45,028) [10,807] {5,403}	225,362 (45,072) [10,817] {5,409}
Monroe	37,522	37,533	37,544	37,544	37,571 (7,514) [1,803] {902}	37,595 (7,519) [1,805] {902}	37,616 (7,523) [1,806] {903}
Oakland	281,917	281,998	282,079	282,079	282,383 (56,477) [13,554] {6,777}	282,669 (56,534) [13,568] {6,784}	282,944 (56,589) [13,581] {6,791}
Washtenaw	72,821	72,868	72,915	72,915	73,097 (14,619) [3,509] {1,754}	73,265 (14,653) [3,517] {1,758}	73,432 (14,686) [3,525] {1,762}
Wayne	392,504	392,588	392,673	392,673	393,009 (78,602) [18,864] {9,432}	393,335 (78,667) [18,880] {9,440}	393,634 (78,727) [18,894] {9,447}

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.