IEM's AI Modeling: Short-term COVID-19 Projections
Date: 4/12/21

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 4/12/21 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
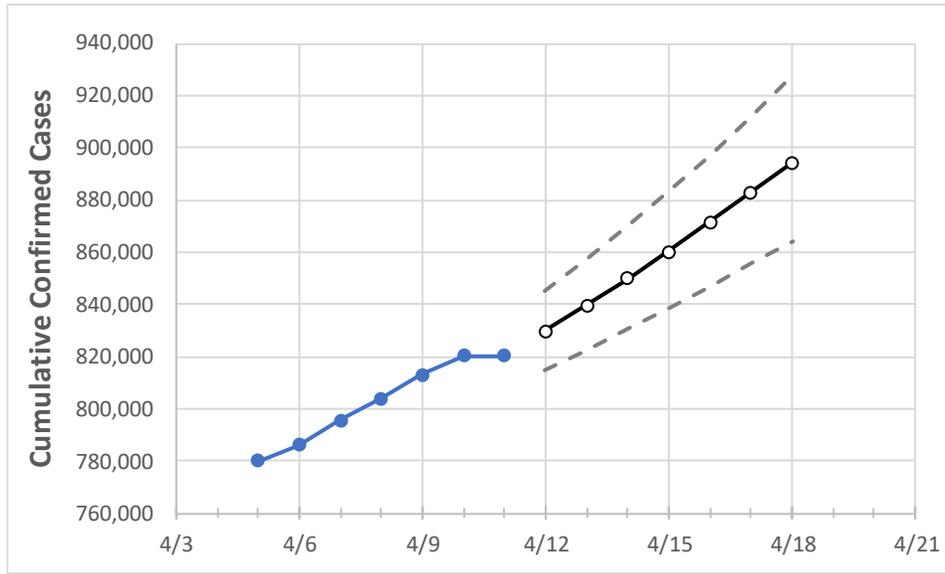
	Actual Confirmed Cases On:				Projected Cases For:						
	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18
Michigan	804,031	812,865	820,404	820,404	829,848	839,671	849,833	860,263	871,371	882,756	894,375

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:						
	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18
Genesee	33,033	33,541	33,864	33,864	34,322	34,799	35,294	35,821	36,353	36,908	37,497
Ingham	20,817	21,053	21,227	21,227	21,438	21,658	21,878	22,099	22,327	22,564	22,805
Kent	59,470	59,926	60,392	60,392	60,906	61,442	62,000	62,585	63,190	63,844	64,499
Livingston	13,340	13,478	13,646	13,646	13,801	13,962	14,135	14,308	14,482	14,668	14,855
Macomb	80,050	81,085	81,863	81,863	83,004	84,160	85,369	86,604	87,879	89,187	90,514
Monroe	12,469	12,610	12,777	12,777	12,926	13,083	13,247	13,418	13,597	13,783	13,974
Oakland	95,266	96,371	97,070	97,070	98,174	99,316	100,476	101,678	102,957	104,203	105,538
Washtenaw	22,348	22,544	22,746	22,746	22,984	23,243	23,503	23,784	24,074	24,376	24,693
Wayne	130,075	131,774	133,169	133,169	135,029	137,015	139,057	141,235	143,481	145,834	148,280

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:		
	4/8	4/9	4/10	4/11	4/13	4/15	4/17
Genesee	33,033	33,541	33,864	33,864	34,799 (6,960) [1,670] {835}	35,821 (7,164) [1,719] {860}	36,908 (7,382) [1,772] {886}
Ingham	20,817	21,053	21,227	21,227	21,658 (4,332) [1,040] {520}	22,099 (4,420) [1,061] {530}	22,564 (4,513) [1,083] {542}
Kent	59,470	59,926	60,392	60,392	61,442 (12,288) [2,949] {1,475}	62,585 (12,517) [3,004] {1,502}	63,844 (12,769) [3,065] {1,532}
Livingston	13,340	13,478	13,646	13,646	13,962 (2,792) [670] {335}	14,308 (2,862) [687] {343}	14,668 (2,934) [704] {352}
Macomb	80,050	81,085	81,863	81,863	84,160 (16,832) [4,040] {2,020}	86,604 (17,321) [4,157] {2,078}	89,187 (17,837) [4,281] {2,140}
Monroe	12,469	12,610	12,777	12,777	13,083 (2,617) [628] {314}	13,418 (2,684) [644] {322}	13,783 (2,757) [662] {331}
Oakland	95,266	96,371	97,070	97,070	99,316 (19,863) [4,767] {2,384}	101,678 (20,336) [4,881] {2,440}	104,203 (20,841) [5,002] {2,501}
Washtenaw	22,348	22,544	22,746	22,746	23,243 (4,649) [1,116] {558}	23,784 (4,757) [1,142] {571}	24,376 (4,875) [1,170] {585}
Wayne	130,075	131,774	133,169	133,169	137,015 (27,403) [6,577] {3,288}	141,235 (28,247) [6,779] {3,390}	145,834 (29,167) [7,000] {3,500}

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.