IEM's AI Modeling: Short-term COVID-19 Projections
Date: 5/19/21

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 5/19/21 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
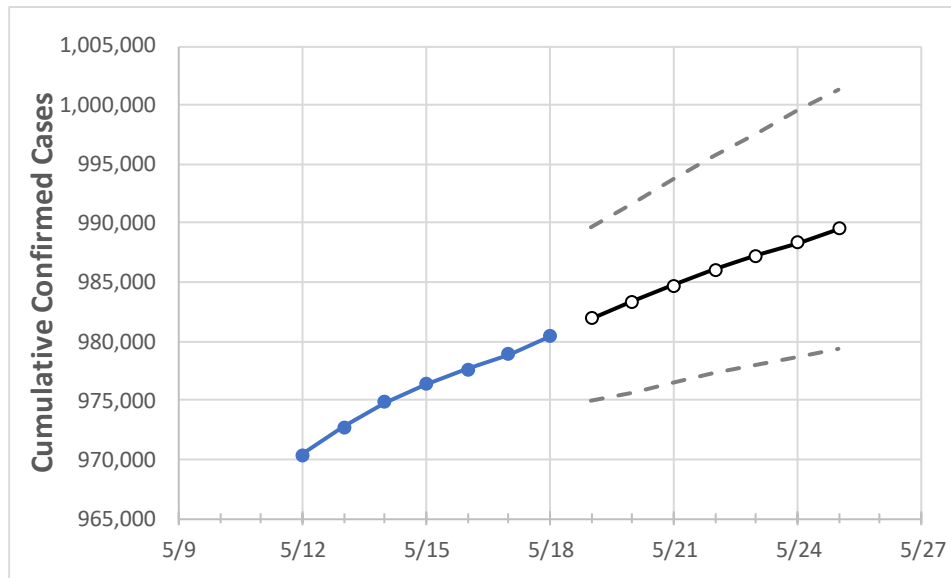
	Actual Confirmed Cases On:				Projected Cases For:						
	5/15	5/16	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25
Michigan	976,339	977,627	978,915	980,450	981,957	983,374	984,726	986,048	987,260	988,379	989,495

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:						
	5/15	5/16	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25
Genesee	41,098	41,136	41,174	41,231	41,275	41,314	41,350	41,386	41,420	41,452	41,481
Ingham	24,388	24,420	24,452	24,478	24,508	24,536	24,564	24,590	24,615	24,639	24,662
Kent	71,191	71,347	71,502	71,623	71,753	71,876	71,997	72,112	72,217	72,320	72,422
Livingston	16,411	16,430	16,448	16,466	16,484	16,503	16,518	16,534	16,548	16,562	16,577
Macomb	98,195	98,325	98,454	98,549	98,662	98,766	98,863	98,957	99,043	99,125	99,203
Monroe	15,096	15,114	15,131	15,147	15,164	15,181	15,196	15,211	15,224	15,237	15,249
Oakland	116,183	116,295	116,407	116,550	116,750	116,931	117,116	117,281	117,455	117,611	117,751
Washtenaw	26,101	26,124	26,147	26,165	26,189	26,213	26,233	26,253	26,272	26,289	26,308
Wayne	161,531	161,770	162,008	162,225	162,449	162,668	162,879	163,075	163,260	163,434	163,600

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:		
	5/15	5/16	5/17	5/18	5/20	5/22	5/24
Genesee	41,098	41,136	41,174	41,231	41,314 (8,263) [1,983] {992}	41,386 (8,277) [1,987] {993}	41,452 (8,290) [1,990] {995}
Ingham	24,388	24,420	24,452	24,478	24,536 (4,907) [1,178] {589}	24,590 (4,918) [1,180] {590}	24,639 (4,928) [1,183] {591}
Kent	71,191	71,347	71,502	71,623	71,876 (14,375) [3,450] {1,725}	72,112 (14,422) [3,461] {1,731}	72,320 (14,464) [3,471] {1,736}
Livingston	16,411	16,430	16,448	16,466	16,503 (3,301) [792] {396}	16,534 (3,307) [794] {397}	16,562 (3,312) [795] {397}
Macomb	98,195	98,325	98,454	98,549	98,766 (19,753) [4,741] {2,370}	98,957 (19,791) [4,750] {2,375}	99,125 (19,825) [4,758] {2,379}
Monroe	15,096	15,114	15,131	15,147	15,181 (3,036) [729] {364}	15,211 (3,042) [730] {365}	15,237 (3,047) [731] {366}
Oakland	116,183	116,295	116,407	116,550	116,931 (23,386) [5,613] {2,806}	117,281 (23,456) [5,630] {2,815}	117,611 (23,522) [5,645] {2,823}
Washtenaw	26,101	26,124	26,147	26,165	26,213 (5,243) [1,258] {629}	26,253 (5,251) [1,260] {630}	26,289 (5,258) [1,262] {631}
Wayne	161,531	161,770	162,008	162,225	162,668 (32,534) [7,808] {3,904}	163,075 (32,615) [7,828] {3,914}	163,434 (32,687) [7,845] {3,922}

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.