IEM's AI Modeling: Short-term COVID-19 Projections
Date: 6/17/21

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 6/17/21 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
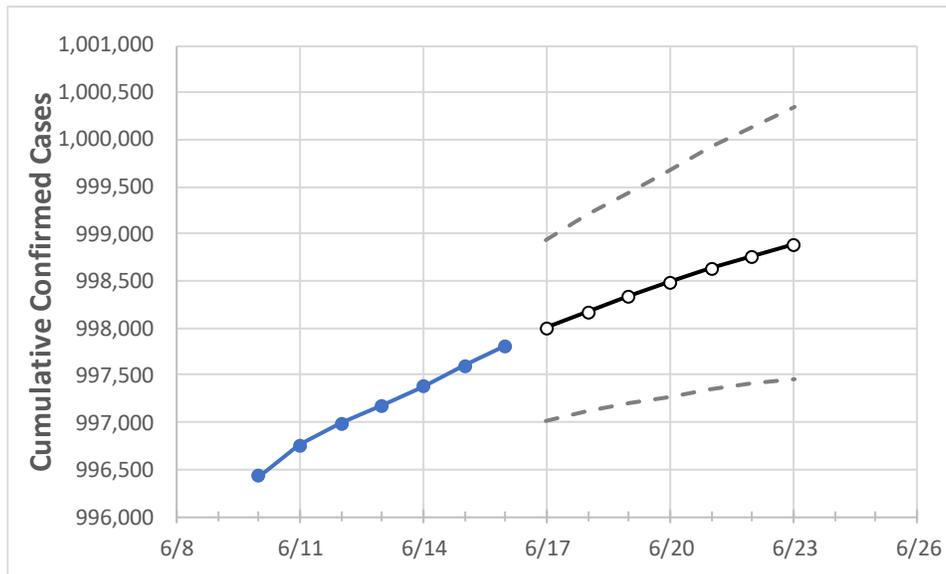
	Actual Confirmed Cases On:				Projected Cases For:						
	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20	6/21	6/22	6/23
Michigan	997,181	997,375	997,595	997,816	997,996	998,172	998,338	998,487	998,633	998,760	998,891

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:						
	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20	6/21	6/22	6/23
Genesee	41,689	41,690	41,696	41,711	41,715	41,718	41,721	41,724	41,727	41,729	41,732
Ingham	24,856	24,860	24,862	24,865	24,869	24,873	24,876	24,880	24,883	24,886	24,889
Kent	73,182	73,208	73,212	73,225	73,240	73,255	73,268	73,281	73,292	73,303	73,313
Livingston	16,708	16,711	16,712	16,716	16,719	16,722	16,725	16,728	16,730	16,733	16,735
Macomb	100,010	100,029	100,051	100,067	100,083	100,098	100,112	100,126	100,139	100,151	100,162
Monroe	15,394	15,395	15,405	15,412	15,415	15,418	15,421	15,423	15,426	15,428	15,430
Oakland	118,415	118,439	118,457	118,484	118,503	118,520	118,536	118,550	118,565	118,578	118,590
Washtenaw	26,444	26,448	26,454	26,460	26,463	26,466	26,469	26,472	26,475	26,478	26,480
Wayne	165,254	165,293	165,353	165,389	165,432	165,474	165,514	165,551	165,588	165,620	165,653

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:		
	6/13	6/14	6/15	6/16	6/18	6/20	6/22
Genesee	41,689	41,690	41,696	41,711	41,718 (8,344) [2,002] {1,001}	41,724 (8,345) [2,003] {1,001}	41,729 (8,346) [2,003] {1,002}
Ingham	24,856	24,860	24,862	24,865	24,873 (4,975) [1,194] {597}	24,880 (4,976) [1,194] {597}	24,886 (4,977) [1,195] {597}
Kent	73,182	73,208	73,212	73,225	73,255 (14,651) [3,516] {1,758}	73,281 (14,656) [3,517] {1,759}	73,303 (14,661) [3,519] {1,759}
Livingston	16,708	16,711	16,712	16,716	16,722 (3,344) [803] {401}	16,728 (3,346) [803] {401}	16,733 (3,347) [803] {402}
Macomb	100,010	100,029	100,051	100,067	100,098 (20,020) {4,805} {2,402}	100,126 (20,025) [4,806] {2,403}	100,151 (20,030) [4,807] {2,404}
Monroe	15,394	15,395	15,405	15,412	15,418 (3,084) [740] {370}	15,423 (3,085) [740] {370}	15,428 (3,086) [741] {370}
Oakland	118,415	118,439	118,457	118,484	118,520 (23,704) [5,689] {2,844}	118,550 (23,710) [5,690] {2,845}	118,578 (23,716) [5,692] {2,846}
Washtenaw	26,444	26,448	26,454	26,460	26,466 (5,293) [1,270] {635}	26,472 (5,294) [1,271] {635}	26,478 (5,296) [1,271] {635}
Wayne	165,254	165,293	165,353	165,389	165,474 (33,095) [7,943] {3,971}	165,551 (33,110) [7,946] {3,973}	165,620 (33,124) [7,950] {3,975}

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.