IEM's AI Modeling: Short-term COVID-19 Projections
Date: 1/25/21

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 1/25/21 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
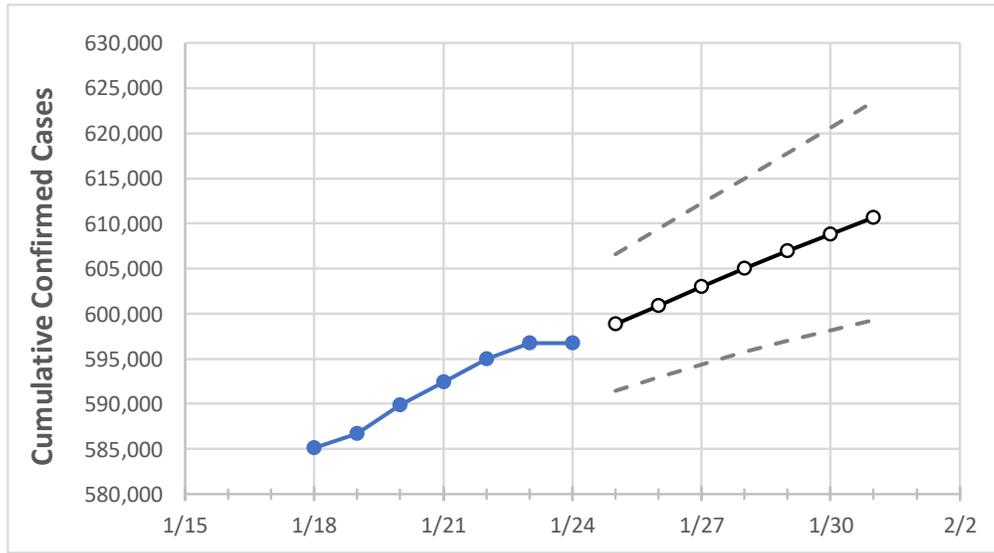
	Actual Confirmed Cases On:				Projected Cases For:						
	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31
Michigan	592,382	594,920	596,746	596,746	598,830	600,899	602,975	604,972	606,934	608,803	610,638

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:						
	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31
Genesee	23,839	23,916	23,981	23,981	24,064	24,144	24,221	24,299	24,375	24,449	24,521
Ingham	14,405	14,493	14,534	14,534	14,608	14,680	14,755	14,827	14,900	14,973	15,041
Kent	48,029	48,198	48,320	48,320	48,472	48,626	48,775	48,919	49,057	49,198	49,338
Livingston	9,204	9,250	9,291	9,291	9,337	9,386	9,433	9,479	9,525	9,569	9,613
Macomb	54,315	54,565	54,764	54,764	54,954	55,140	55,328	55,511	55,690	55,871	56,048
Monroe	8,825	8,876	8,909	8,909	8,951	8,992	9,033	9,073	9,112	9,149	9,188
Oakland	68,496	68,795	68,958	68,958	69,203	69,449	69,684	69,914	70,145	70,376	70,592
Washtenaw	15,778	15,854	15,933	15,933	16,008	16,082	16,155	16,226	16,299	16,371	16,442
Wayne	94,091	94,453	94,689	94,689	95,014	95,339	95,658	95,960	96,276	96,568	96,867

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:		
	1/21	1/22	1/23	1/24	1/26	1/28	1/30
Genesee	23,839	23,916	23,981	23,981	24,144 (4,829) [1,159] {579}	24,299 (4,860) [1,166] {583}	24,449 (4,890) [1,174] {587}
Ingham	14,405	14,493	14,534	14,534	14,680 (2,936) [705] {352}	14,827 (2,965) [712] {356}	14,973 (2,995) [719] {359}
Kent	48,029	48,198	48,320	48,320	48,626 (9,725) [2,334] {1,167}	48,919 (9,784) [2,348] {1,174}	49,198 (9,840) [2,361] {1,181}
Livingston	9,204	9,250	9,291	9,291	9,386 (1,877) [451] {225}	9,479 (1,896) [455] {228}	9,569 (1,914) [459] {230}
Macomb	54,315	54,565	54,764	54,764	55,140 (11,028) [2,647] {1,323}	55,511 (11,102) [2,665] {1,332}	55,871 (11,174) [2,682] {1,341}
Monroe	8,825	8,876	8,909	8,909	8,992 (1,798) [432] {216}	9,073 (1,815) [435] {218}	9,149 (1,830) [439] {220}
Oakland	68,496	68,795	68,958	68,958	69,449 (13,890) [3,334] {1,667}	69,914 (13,983) [3,356] {1,678}	70,376 (14,075) [3,378] {1,689}
Washtenaw	15,778	15,854	15,933	15,933	16,082 (3,216) [772] {386}	16,226 (3,245) [779] {389}	16,371 (3,274) [786] {393}
Wayne	94,091	94,453	94,689	94,689	95,339 (19,068) [4,576] {2,288}	95,960 (19,192) [4,606] {2,303}	96,568 (19,314) [4,635] {2,318}

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.