IEM's AI Modeling: Short-term COVID-19 Projections
Date: 1/11/21

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 not 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 1/11/21 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
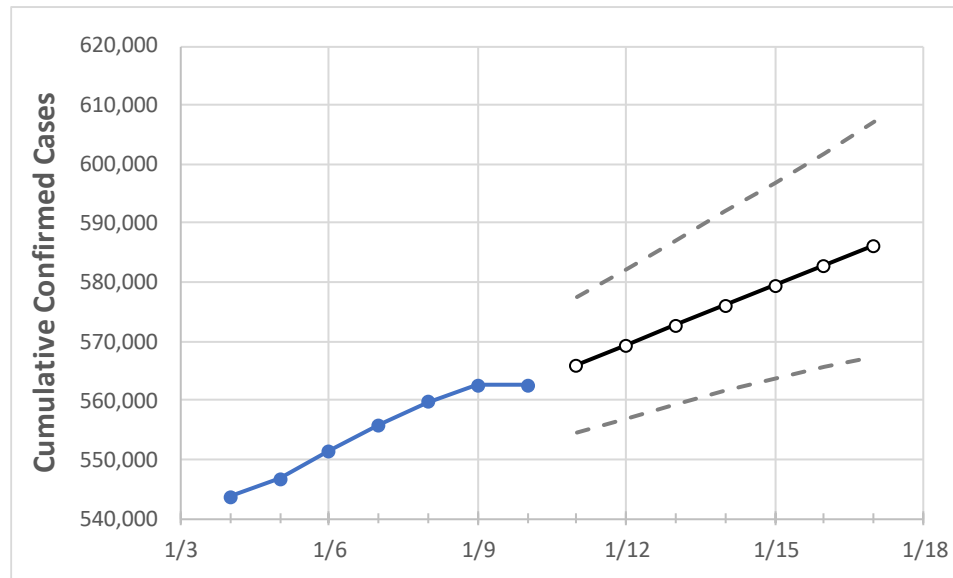
	Actual Confirmed Cases On:				Projected Cases For:						
	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17
Michigan	555,747	559,655	562,553	562,553	565,981	569,332	572,715	576,013	579,377	582,829	586,257

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:						
	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17
Genesee	22,398	22,511	22,643	22,643	22,717	22,793	22,861	22,930	22,996	23,057	23,116
Ingham	13,266	13,324	13,434	13,434	13,510	13,588	13,664	13,739	13,815	13,891	13,968
Kent	45,313	45,622	45,835	45,835	46,088	46,343	46,605	46,865	47,129	47,390	47,654
Livingston	8,415	8,478	8,535	8,535	8,614	8,695	8,779	8,861	8,948	9,037	9,130
Macomb	51,460	51,779	51,967	51,967	52,196	52,425	52,657	52,887	53,120	53,351	53,576
Monroe	8,147	8,195	8,249	8,249	8,314	8,381	8,448	8,517	8,586	8,655	8,724
Oakland	64,221	64,666	64,880	64,880	65,260	65,642	66,029	66,420	66,815	67,204	67,593
Washtenaw	14,559	14,712	14,781	14,781	14,893	15,005	15,120	15,237	15,354	15,470	15,589
Wayne	88,524	89,136	89,516	89,516	89,925	90,325	90,716	91,119	91,515	91,912	92,289

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:		
	1/7	1/8	1/9	1/10	1/12	1/14	1/16
Genesee	22,398	22,511	22,643	22,643	22,793 (4,559) [1,094] {547}	22,930 (4,586) [1,101] {550}	23,057 (4,611) [1,107] {553}
Ingham	13,266	13,324	13,434	13,434	13,588 (2,718) [652] {326}	13,739 (2,748) [659] {330}	13,891 (2,778) [667] {333}
Kent	45,313	45,622	45,835	45,835	46,343 (9,269) [2,224] {1,112}	46,865 (9,373) [2,250] {1,125}	47,390 (9,478) [2,275] {1,137}
Livingston	8,415	8,478	8,535	8,535	8,695 (1,739) [417] {209}	8,861 (1,772) [425] {213}	9,037 (1,807) [434] {217}
Macomb	51,460	51,779	51,967	51,967	52,425 (10,485) [2,516] {1,258}	52,887 (10,577) [2,539] {1,269}	53,351 (10,670) [2,561] {1,280}
Monroe	8,147	8,195	8,249	8,249	8,381 (1,676) [402] {201}	8,517 (1,703) [409] {204}	8,655 (1,731) [415] {208}
Oakland	64,221	64,666	64,880	64,880	65,642 (13,128) [3,151] {1,575}	66,420 (13,284) [3,188] {1,594}	67,204 (13,441) [3,226] {1,613}
Washtenaw	14,559	14,712	14,781	14,781	15,005 (3,001) [720] {360}	15,237 (3,047) [731] {366}	15,470 (3,094) [743] {371}
Wayne	88,524	89,136	89,516	89,516	90,325 (18,065) [4,336] {2,168}	91,119 (18,224) [4,374] {2,187}	91,912 (18,382) [4,412] {2,206}

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.