IEM's AI Modeling: Short-term COVID-19 Projections
Date: 3/18/22

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 3/18/22 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
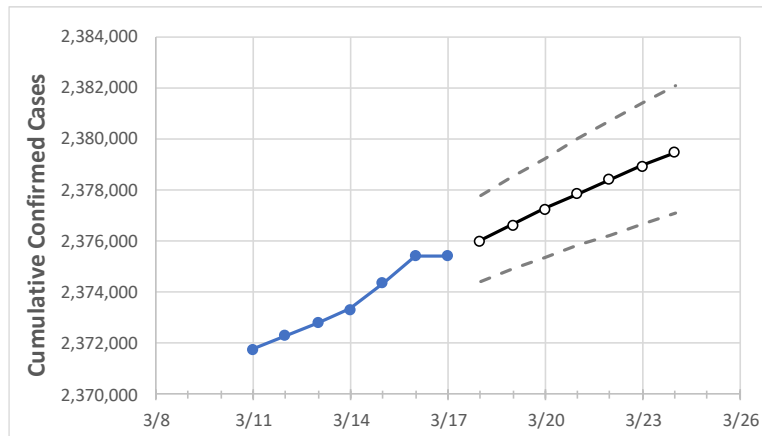
	Actual Confirmed Cases On:				Projected Cases For:						
	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23	3/24
Michigan	2,373,336	2,374,383	2,375,430	2,375,430	2,376,038	2,376,658	2,377,277	2,377,853	2,378,414	2,378,953	2,379,482

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:						
	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23	3/24
Genesee	100,503	100,564	100,624	100,624	100,648	100,670	100,689	100,711	100,731	100,751	100,769
Ingham	63,429	63,457	63,484	63,484	63,500	63,516	63,532	63,546	63,562	63,575	63,588
Kent	165,589	165,629	165,669	165,669	165,704	165,737	165,770	165,801	165,833	165,864	165,893
Livingston	45,552	45,590	45,627	45,627	45,643	45,659	45,675	45,690	45,705	45,721	45,736
Macomb	226,496	226,651	226,806	226,806	226,907	227,011	227,110	227,206	227,306	227,399	227,493
Monroe	37,695	37,715	37,734	37,734	37,742	37,751	37,759	37,767	37,775	37,783	37,790
Oakland	283,642	283,777	283,912	283,912	283,998	284,080	284,159	284,239	284,315	284,393	284,462
Washtenaw	73,590	73,637	73,684	73,684	73,716	73,748	73,777	73,807	73,835	73,863	73,890
Wayne	394,841	395,034	395,227	395,227	395,362	395,502	395,634	395,768	395,900	396,030	396,155

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:		
	3/14	3/15	3/16	3/17	3/19	3/21	3/23
Genesee	100,503	100,564	100,624	100,624	100,670 (20,134) [4,832] {2,416}	100,711 (20,142) [4,834] {2,417}	100,751 (20,150) [4,836] {2,418}
Ingham	63,429	63,457	63,484	63,484	63,516 (12,703) [3,049] {1,524}	63,546 (12,709) [3,050] {1,525}	63,575 (12,715) [3,052] {1,526}
Kent	165,589	165,629	165,669	165,669	165,737 (33,147) [7,955] {3,978}	165,801 (33,160) [7,958] {3,979}	165,864 (33,173) [7,961] {3,981}
Livingston	45,552	45,590	45,627	45,627	45,659 (9,132) [2,192] {1,096}	45,690 (9,138) [2,193] {1,097}	45,721 (9,144) [2,195] {1,097}
Macomb	226,496	226,651	226,806	226,806	227,011 (45,402) [10,897] {5,448}	227,206 (45,441) [10,906] {5,453}	227,399 (45,480) [10,915] {5,458}
Monroe	37,695	37,715	37,734	37,734	37,751 (7,550) [1,812] {906}	37,767 (7,553) [1,813] {906}	37,783 (7,557) [1,814] {907}
Oakland	283,642	283,777	283,912	283,912	284,080 (56,816) [13,636] {6,818}	284,239 (56,848) [13,643] {6,822}	284,393 (56,879) [13,651] {6,825}
Washtenaw	73,590	73,637	73,684	73,684	73,748 (14,750) [3,540] {1,770}	73,807 (14,761) [3,543] {1,771}	73,863 (14,773) [3,545] {1,773}
Wayne	394,841	395,034	395,227	395,227	395,502 (79,100) [18,984] {9,492}	395,768 (79,154) [18,997] {9,498}	396,030 (79,206) [19,009] {9,505}

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.