IEM's AI Modeling: Short-term COVID-19 Projections

Date: 2/11/22

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 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 2/11/22 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.

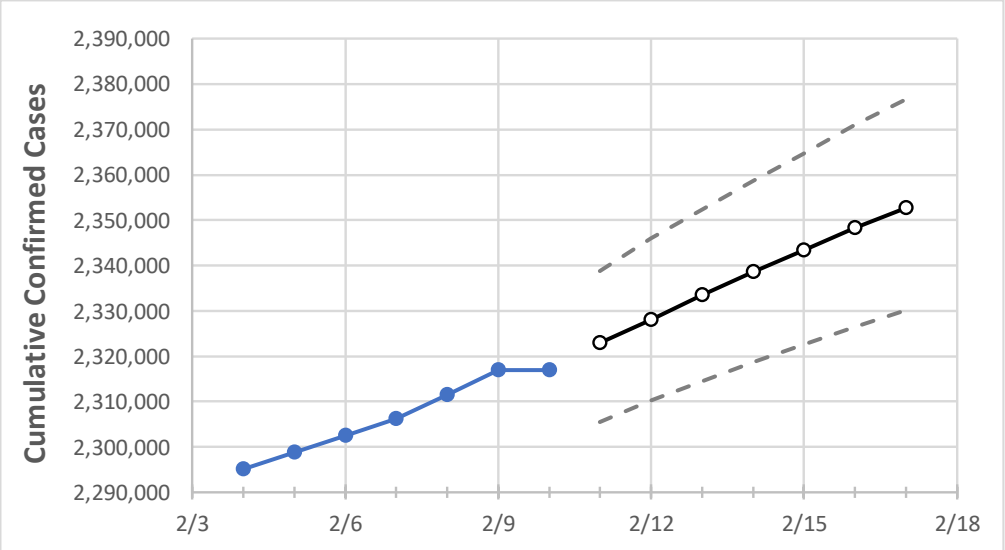
IEM's Modeling Lead

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:						
	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17
Michigan	2,306,153	2,311,512	2,316,871	2,316,871	2,322,856	2,328,073	2,333,478	2,338,562	2,343,413	2,348,246	2,352,734

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:						
	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17
Genesee	97,764	98,051	98,337	98,337	98,561	98,764	98,958	99,157	99,339	99,526	99,690
Ingham	61,404	61,568	61,732	61,732	61,900	62,074	62,222	62,376	62,518	62,656	62,789
Kent	161,317	161,652	161,987	161,987	162,360	162,698	163,039	163,366	163,666	163,975	164,261
Livingston	44,399	44,467	44,534	44,534	44,590	44,647	44,697	44,744	44,790	44,836	44,877
Macomb	220,602	220,919	221,235	221,235	221,764	222,232	222,700	223,122	223,549	223,985	224,359
Monroe	36,875	36,940	37,005	37,005	37,070	37,131	37,189	37,245	37,302	37,350	37,400
Oakland	275,456	276,120	276,783	276,783	277,519	278,194	278,852	279,493	280,107	280,715	281,266
Washtenaw	70,184	70,404	70,624	70,624	70,798	70,968	71,123	71,275	71,416	71,565	71,701
Wayne	385,873	386,510	387,147	387,147	388,063	388,921	389,771	390,579	391,323	392,114	392,834

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:		
	2/7	2/8	2/9	2/10	2/12	2/14	2/16
Genesee	97,764	98,051	98,337	98,337	98,764 (19,753) [4,741] {2,370}	99,157 (19,831) [4,760] {2,380}	99,526 (19,905) [4,777] {2,389}
Ingham	61,404	61,568	61,732	61,732	62,074 (12,415) [2,980] {1,490}	62,376 (12,475) [2,994] {1,497}	62,656 (12,531) [3,007] {1,504}
Kent	161,317	161,652	161,987	161,987	162,698 (32,540) [7,810] {3,905}	163,366 (32,673) [7,842] {3,921}	163,975 (32,795) [7,871] {3,935}
Livingston	44,399	44,467	44,534	44,534	44,647 (8,929) [2,143] {1,072}	44,744 (8,949) [2,148] {1,074}	44,836 (8,967) [2,152] {1,076}
Macomb	220,602	220,919	221,235	221,235	222,232 (44,446) [10,667] {5,334}	223,122 (44,624) [10,710] {5,355}	223,985 (44,797) [10,751] {5,376}
Monroe	36,875	36,940	37,005	37,005	37,131 (7,426) [1,782] {891}	37,245 (7,449) [1,788] {894}	37,350 (7,470) [1,793] {896}
Oakland	275,456	276,120	276,783	276,783	278,194 (55,639) [13,353] {6,677}	279,493 (55,899) [13,416] {6,708}	280,715 (56,143) [13,474] {6,737}
Washtenaw	70,184	70,404	70,624	70,624	70,968 (14,194) [3,406] {1,703}	71,275 (14,255) [3,421] {1,711}	71,565 (14,313) [3,435] {1,718}
Wayne	385,873	386,510	387,147	387,147	388,921 (77,784) [18,668] {9,334}	390,579 (78,116) [18,748] {9,374}	392,114 (78,423) [18,821] {9,411}

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.