IEM's AI Modeling: Short-term COVID-19 Projections
Date: 4/1/21

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 4/1/21 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
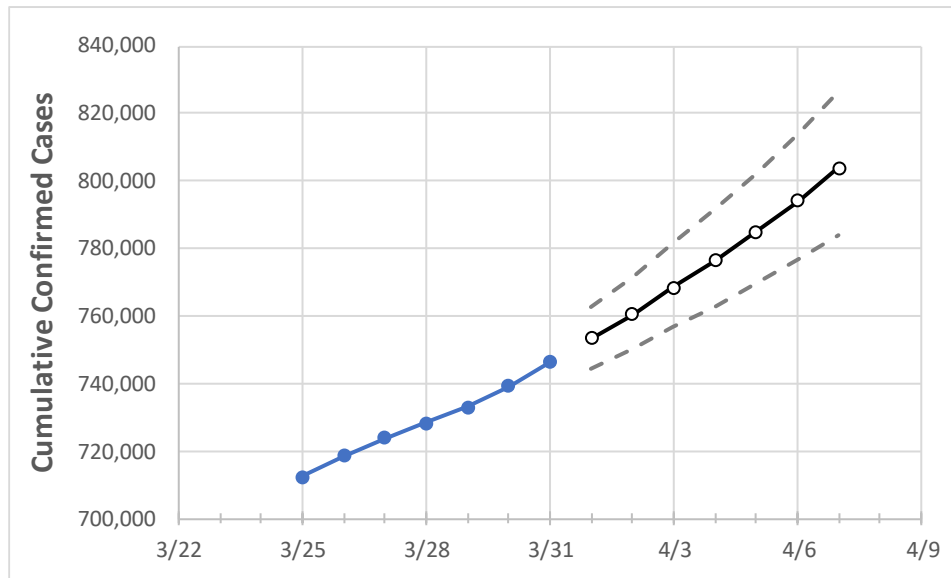
	Actual Confirmed Cases On:				Projected Cases For:						
	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	4/6	4/7
Michigan	728,319	732,938	739,244	746,351	753,247	760,518	768,289	776,432	785,027	794,214	803,782

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:						
	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	4/6	4/7
Genesee	29,572	29,742	29,985	30,311	30,614	30,935	31,270	31,627	32,011	32,411	32,828
Ingham	18,891	19,028	19,257	19,426	19,629	19,843	20,066	20,298	20,546	20,804	21,077
Kent	55,679	55,927	56,134	56,565	56,913	57,289	57,686	58,106	58,558	59,031	59,542
Livingston	11,963	12,066	12,189	12,303	12,431	12,568	12,711	12,860	13,017	13,180	13,353
Macomb	69,854	70,608	71,578	72,578	73,672	74,838	76,097	77,438	78,872	80,401	82,014
Monroe	11,251	11,304	11,441	11,584	11,691	11,802	11,917	12,037	12,161	12,292	12,430
Oakland	85,616	86,247	87,010	87,871	88,776	89,730	90,729	91,784	92,905	94,072	95,295
Washtenaw	20,548	20,662	20,805	20,946	21,108	21,278	21,459	21,656	21,861	22,086	22,321
Wayne	115,712	116,612	117,758	118,987	120,256	121,611	123,051	124,593	126,234	127,967	129,814

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:		
	3/28	3/29	3/30	3/31	4/2	4/4	4/6
Genesee	29,572	29,742	29,985	30,311	30,935 (6,187) [1,485] {742}	31,627 (6,325) [1,518] {759}	32,411 (6,482) [1,556] {778}
Ingham	18,891	19,028	19,257	19,426	19,843 (3,969) [952] {476}	20,298 (4,060) [974] {487}	20,804 (4,161) [999] {499}
Kent	55,679	55,927	56,134	56,565	57,289 (11,458) [2,750] {1,375}	58,106 (11,621) [2,789] {1,395}	59,031 (11,806) [2,834] {1,417}
Livingston	11,963	12,066	12,189	12,303	12,568 (2,514) [603] {302}	12,860 (2,572) [617] {309}	13,180 (2,636) [633] {316}
Macomb	69,854	70,608	71,578	72,578	74,838 (14,968) [3,592] {1,796}	77,438 (15,488) [3,717] {1,859}	80,401 (16,080) [3,859] {1,930}
Monroe	11,251	11,304	11,441	11,584	11,802 (2,360) [566] {283}	12,037 (2,407) [578] {289}	12,292 (2,458) [590] {295}
Oakland	85,616	86,247	87,010	87,871	89,730 (17,946) [4,307] {2,154}	91,784 (18,357) [4,406] {2,203}	94,072 (18,814) [4,515] {2,258}
Washtenaw	20,548	20,662	20,805	20,946	21,278 (4,256) [1,021] {511}	21,656 (4,331) [1,039] {520}	22,086 (4,417) [1,060] {530}
Wayne	115,712	116,612	117,758	118,987	121,611 (24,322) [5,837] {2,919}	124,593 (24,919) [5,980] {2,990}	127,967 (25,593) [6,142] {3,071}

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.