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

Date: 3/25/21

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 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 3/25/21 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.

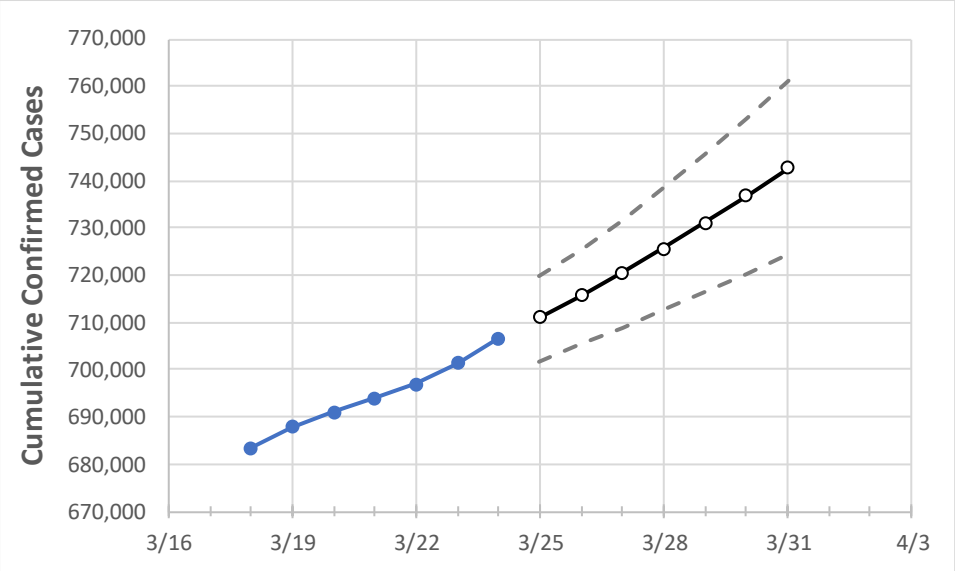
IEM's Modeling Lead

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:						
	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	3/31
Michigan	693,954	696,838	701,378	706,550	711,049	715,657	720,557	725,642	731,076	736,732	742,682

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:						
	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	3/31
Genesee	27,916	28,035	28,248	28,466	28,671	28,879	29,100	29,332	29,577	29,836	30,101
Ingham	17,870	17,975	18,073	18,267	18,405	18,554	18,708	18,866	19,040	19,220	19,403
Kent	54,012	54,146	54,300	54,593	54,773	54,962	55,155	55,359	55,570	55,791	56,022
Livingston	11,295	11,362	11,451	11,549	11,637	11,729	11,825	11,926	12,033	12,145	12,261
Macomb	64,922	65,318	65,921	66,617	67,239	67,907	68,614	69,360	70,169	71,016	71,921
Monroe	10,753	10,790	10,864	10,923	10,988	11,054	11,123	11,193	11,266	11,343	11,421
Oakland	80,908	81,335	81,961	82,624	83,267	83,952	84,692	85,477	86,304	87,185	88,124
Washtenaw	19,715	19,776	19,886	19,963	20,035	20,110	20,187	20,266	20,348	20,431	20,518
Wayne	109,805	110,373	111,118	111,911	112,648	113,427	114,244	115,112	116,032	117,020	118,053

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:		
	3/21	3/22	3/23	3/24	3/26	3/28	3/30
Genesee	27,916	28,035	28,248	28,466	28,879 (5,776) [1,386] {693}	29,332 (5,866) [1,408] {704}	29,836 (5,967) [1,432] {716}
Ingham	17,870	17,975	18,073	18,267	18,554 (3,711) [891] {445}	18,866 (3,773) [906] {453}	19,220 (3,844) [923] {461}
Kent	54,012	54,146	54,300	54,593	54,962 (10,992) [2,638] {1,319}	55,359 (11,072) [2,657] {1,329}	55,791 (11,158) [2,678] {1,339}
Livingston	11,295	11,362	11,451	11,549	11,729 (2,346) [563] {281}	11,926 (2,385) [572] {286}	12,145 (2,429) [583] {291}
Macomb	64,922	65,318	65,921	66,617	67,907 (13,581) [3,260] {1,630}	69,360 (13,872) [3,329] {1,665}	71,016 (14,203) [3,409] {1,704}
Monroe	10,753	10,790	10,864	10,923	11,054 (2,211) [531] {265}	11,193 (2,239) [537] {269}	11,343 (2,269) [544] {272}
Oakland	80,908	81,335	81,961	82,624	83,952 (16,790) [4,030] {2,015}	85,477 (17,095) [4,103] {2,051}	87,185 (17,437) [4,185] {2,092}
Washtenaw	19,715	19,776	19,886	19,963	20,110 (4,022) [965] {483}	20,266 (4,053) [973] {486}	20,431 (4,086) [981] {490}
Wayne	109,805	110,373	111,118	111,911	113,427 (22,685) [5,445] {2,722}	115,112 (23,022) [5,525] {2,763}	117,020 (23,404) [5,617] {2,808}

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.