IEM's AI Modeling: Short-term COVID-19 Projections
Date: 3/24/21

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 <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 3/24/21 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
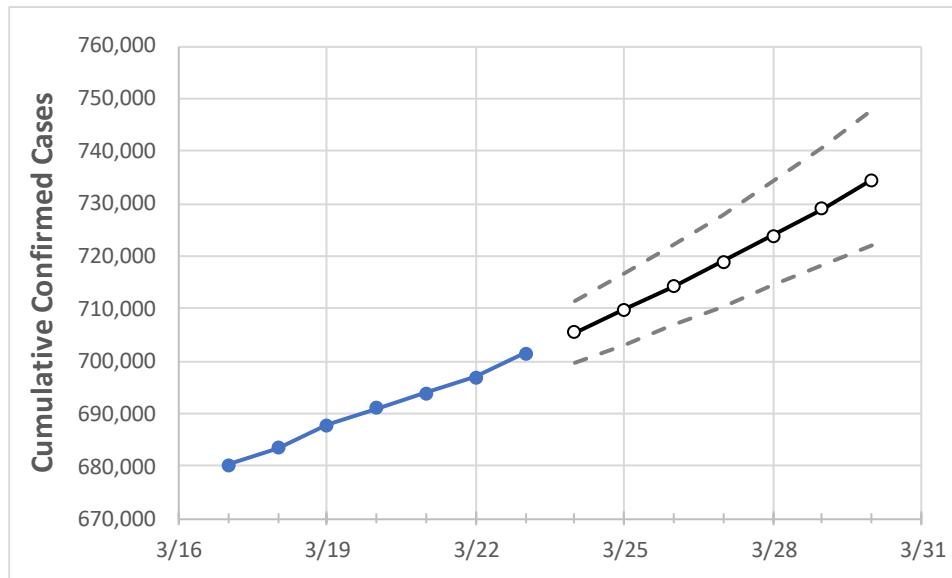
	Actual Confirmed Cases On:				Projected Cases For:						
	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30
Michigan	691,070	693,954	696,838	701,378	705,469	709,750	714,236	718,954	723,848	729,033	734,490

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:						
	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30
Genesee	27,796	27,916	28,035	28,248	28,434	28,629	28,832	29,048	29,270	29,504	29,746
Ingham	17,764	17,870	17,975	18,073	18,197	18,330	18,467	18,608	18,758	18,915	19,078
Kent	53,878	54,012	54,146	54,300	54,452	54,610	54,774	54,945	55,113	55,293	55,479
Livingston	11,228	11,295	11,362	11,451	11,533	11,619	11,708	11,802	11,900	12,002	12,109
Macomb	64,525	64,922	65,318	65,921	66,487	67,083	67,727	68,397	69,107	69,860	70,684
Monroe	10,716	10,753	10,790	10,864	10,928	10,995	11,062	11,132	11,206	11,281	11,359
Oakland	80,481	80,908	81,335	81,961	82,564	83,207	83,888	84,617	85,403	86,229	87,102
Washtenaw	19,654	19,715	19,776	19,886	19,958	20,033	20,110	20,189	20,270	20,353	20,439
Wayne	109,236	109,805	110,373	111,118	111,812	112,531	113,280	114,080	114,905	115,757	116,654

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:		
	3/20	3/21	3/22	3/23	3/25	3/27	3/29
Genesee	27,796	27,916	28,035	28,248	28,629 (5,726) [1,374] {687}	29,048 (5,810) [1,394] {697}	29,504 (5,901) [1,416] {708}
Ingham	17,764	17,870	17,975	18,073	18,330 (3,666) [880] {440}	18,608 (3,722) [893] {447}	18,915 (3,783) [908] {454}
Kent	53,878	54,012	54,146	54,300	54,610 (10,922) [2,621] {1,311}	54,945 (10,989) [2,637] {1,319}	55,293 (11,059) [2,654] {1,327}
Livingston	11,228	11,295	11,362	11,451	11,619 (2,324) [558] {279}	11,802 (2,360) [567] {283}	12,002 (2,400) [576] {288}
Macomb	64,525	64,922	65,318	65,921	67,083 (13,417) [3,220] {1,610}	68,397 (13,679) [3,283] {1,642}	69,860 (13,972) [3,353] {1,677}
Monroe	10,716	10,753	10,790	10,864	10,995 (2,199) [528] {264}	11,132 (2,226) [534] {267}	11,281 (2,256) [542] {271}
Oakland	80,481	80,908	81,335	81,961	83,207 (16,641) [3,994] {1,997}	84,617 (16,923) [4,062] {2,031}	86,229 (17,246) [4,139] {2,070}
Washtenaw	19,654	19,715	19,776	19,886	20,033 (4,007) [962] {481}	20,189 (4,038) [969] {485}	20,353 (4,071) [977] {488}
Wayne	109,236	109,805	110,373	111,118	112,531 (22,506) [5,401] {2,701}	114,080 (22,816) [5,476] {2,738}	115,757 (23,151) [5,556] {2,778}

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.