IEM's AI Modeling: Short-term COVID-19 Projections
Date: 3/15/21

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 3/15/21 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
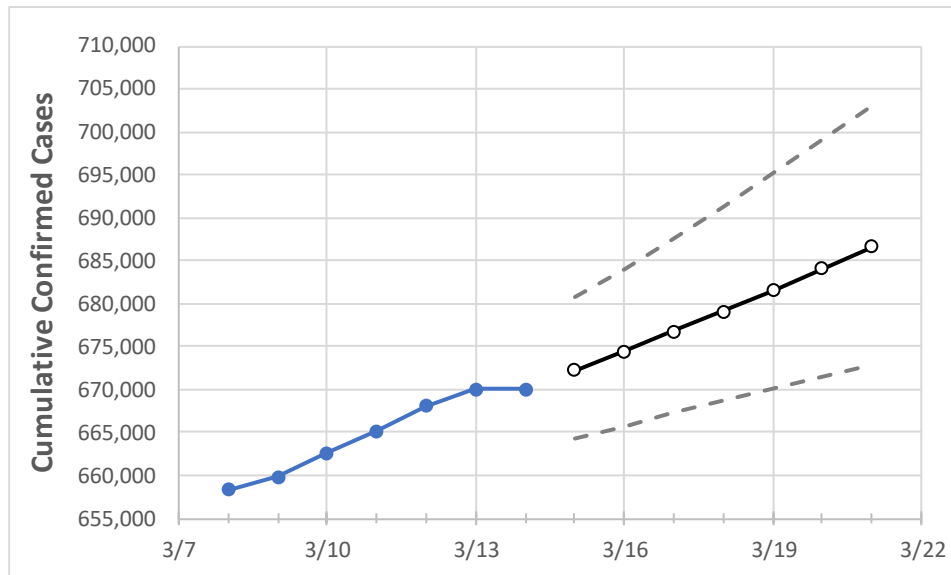
	Actual Confirmed Cases On:				Projected Cases For:						
	3/11	3/12	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21
Michigan	665,141	668,085	670,088	670,088	672,259	674,470	676,793	679,137	681,535	684,065	686,695

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:						
	3/11	3/12	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21
Genesee	26,528	26,681	26,806	26,806	26,941	27,083	27,229	27,388	27,554	27,726	27,907
Ingham	16,961	17,033	17,057	17,057	17,113	17,169	17,226	17,283	17,340	17,400	17,462
Kent	52,723	52,897	53,009	53,009	53,104	53,197	53,289	53,386	53,483	53,583	53,685
Livingston	10,716	10,777	10,813	10,813	10,862	10,911	10,963	11,017	11,072	11,129	11,189
Macomb	61,187	61,549	61,784	61,784	62,068	62,363	62,679	63,011	63,357	63,733	64,117
Monroe	10,234	10,289	10,329	10,329	10,388	10,448	10,512	10,580	10,650	10,723	10,800
Oakland	76,969	77,335	77,604	77,604	77,851	78,103	78,356	78,617	78,892	79,171	79,459
Washtenaw	19,164	19,222	19,261	19,261	19,298	19,333	19,369	19,405	19,441	19,475	19,508
Wayne	105,041	105,591	105,874	105,874	106,251	106,641	107,054	107,475	107,894	108,332	108,804

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:		
	3/11	3/12	3/13	3/14	3/16	3/18	3/20
Genesee	26,528	26,681	26,806	26,806	27,083 (5,417) [1,300] {650}	27,388 (5,478) [1,315] {657}	27,726 (5,545) [1,331] {665}
Ingham	16,961	17,033	17,057	17,057	17,169 (3,434) [824] {412}	17,283 (3,457) [830] {415}	17,400 (3,480) [835] {418}
Kent	52,723	52,897	53,009	53,009	53,197 (10,639) [2,553] {1,277}	53,386 (10,677) [2,563] {1,281}	53,583 (10,717) [2,572] {1,286}
Livingston	10,716	10,777	10,813	10,813	10,911 (2,182) [524] {262}	11,017 (2,203) [529] {264}	11,129 (2,226) [534] {267}
Macomb	61,187	61,549	61,784	61,784	62,363 (12,473) [2,993] {1,497}	63,011 (12,602) [3,025] {1,512}	63,733 (12,747) [3,059] {1,530}
Monroe	10,234	10,289	10,329	10,329	10,448 (2,090) [502] {251}	10,580 (2,116) [508] {254}	10,723 (2,145) [515] {257}
Oakland	76,969	77,335	77,604	77,604	78,103 (15,621) [3,749] {1,874}	78,617 (15,723) [3,774] {1,887}	79,171 (15,834) [3,800] {1,900}
Washtenaw	19,164	19,222	19,261	19,261	19,333 (3,867) [928] {464}	19,405 (3,881) [931] {466}	19,475 (3,895) [935] {467}
Wayne	105,041	105,591	105,874	105,874	106,641 (21,328) [5,119] {2,559}	107,475 (21,495) [5,159] {2,579}	108,332 (21,666) [5,200] {2,600}

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.