IEM's AI Modeling: Short-term COVID-19 Projections
Date: 12/6/21

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 12/6/21 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
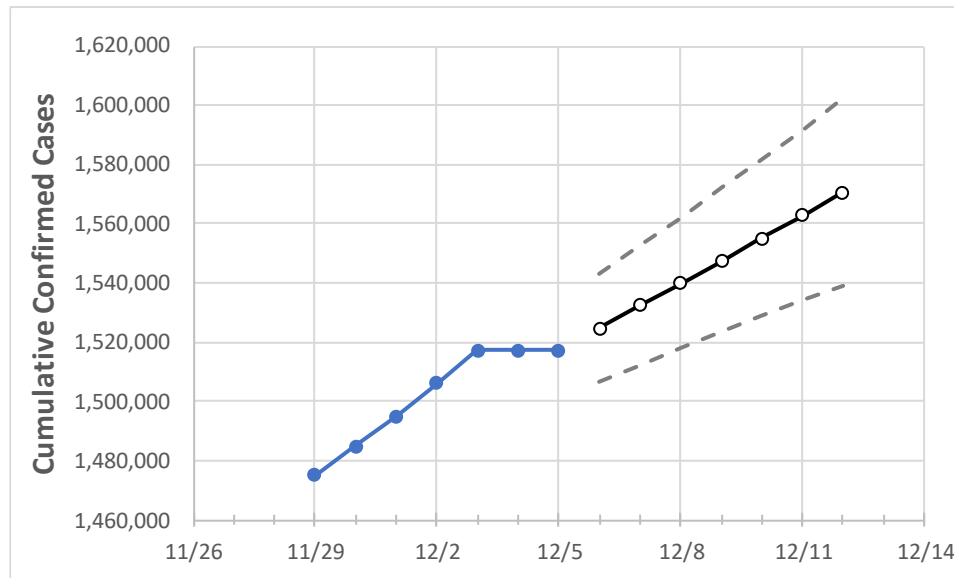
	Actual Confirmed Cases On:				Projected Cases For:						
	12/2	12/3	12/4	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12
Michigan	1,506,139	1,517,325	1,517,325	1,517,325	1,524,847	1,532,512	1,539,898	1,547,384	1,555,253	1,562,928	1,570,540

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:						
	12/2	12/3	12/4	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12
Genesee	62,734	63,328	63,328	63,328	63,739	64,142	64,550	64,955	65,375	65,802	66,220
Ingham	37,219	37,505	37,505	37,505	37,745	37,989	38,244	38,503	38,769	39,030	39,301
Kent	111,404	112,152	112,152	112,152	112,648	113,148	113,632	114,131	114,619	115,117	115,604
Livingston	29,244	29,503	29,503	29,503	29,701	29,895	30,085	30,287	30,484	30,679	30,873
Macomb	142,953	143,926	143,926	143,926	144,743	145,567	146,377	147,205	148,044	148,878	149,735
Monroe	24,225	24,406	24,406	24,406	24,520	24,633	24,745	24,859	24,978	25,088	25,199
Oakland	171,837	173,149	173,149	173,149	174,170	175,178	176,252	177,289	178,342	179,489	180,569
Washtenaw	39,420	39,730	39,730	39,730	39,954	40,168	40,398	40,630	40,855	41,080	41,328
Wayne	232,755	234,312	234,312	234,312	235,557	236,831	238,083	239,371	240,661	242,007	243,322

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:		
	12/2	12/3	12/4	12/5	12/7	12/9	12/11
Genesee	62,734	63,328	63,328	63,328	64,142 (12,828) [3,079] {1,539}	64,955 (12,991) [3,118] {1,559}	65,802 (13,160) [3,158] {1,579}
Ingham	37,219	37,505	37,505	37,505	37,989 (7,598) [1,823] {912}	38,503 (7,701) [1,848] {924}	39,030 (7,806) [1,873] {937}
Kent	111,404	112,152	112,152	112,152	113,148 (22,630) [5,431] {2,716}	114,131 (22,826) [5,478] {2,739}	115,117 (23,023) [5,526] {2,763}
Livingston	29,244	29,503	29,503	29,503	29,895 (5,979) [1,435] {717}	30,287 (6,057) [1,454] {727}	30,679 (6,136) [1,473] {736}
Macomb	142,953	143,926	143,926	143,926	145,567 (29,113) [6,987] {3,494}	147,205 (29,441) [7,066] {3,533}	148,878 (29,776) [7,146] {3,573}
Monroe	24,225	24,406	24,406	24,406	24,633 (4,927) [1,182] {591}	24,859 (4,972) [1,193] {597}	25,088 (5,018) [1,204] {602}
Oakland	171,837	173,149	173,149	173,149	175,178 (35,036) [8,409] {4,204}	177,289 (35,458) [8,510] {4,255}	179,489 (35,898) [8,615] {4,308}
Washtenaw	39,420	39,730	39,730	39,730	40,168 (8,034) [1,928] {964}	40,630 (8,126) [1,950] {975}	41,080 (8,216) [1,972] {986}
Wayne	232,755	234,312	234,312	234,312	236,831 (47,366) [11,368] {5,684}	239,371 (47,874) [11,490] {5,745}	242,007 (48,401) [11,616] {5,808}

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.