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

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 4/21/21 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.

Ohio State Projections
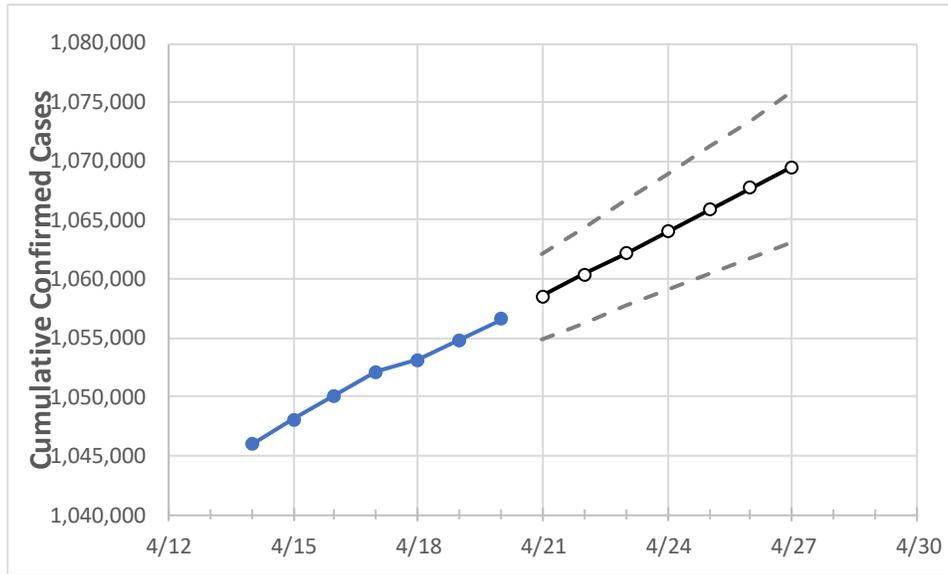
	Actual Confirmed Cases On:				Projected Cases For:						
	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27
Ohio	1,052,099	1,053,175	1,054,807	1,056,606	1,058,500	1,060,359	1,062,210	1,064,046	1,065,892	1,067,732	1,069,550

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.

Ohio Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27
Athens	5,015	5,024	5,038	5,070	5,085	5,101	5,117	5,135	5,152	5,171	5,190
Cuyahoga	107,043	107,210	107,459	107,687	107,971	108,260	108,550	108,836	109,120	109,408	109,687
Franklin	122,167	122,299	122,519	122,789	123,037	123,282	123,532	123,775	124,023	124,268	124,510
Hamilton	78,180	78,220	78,326	78,409	78,505	78,603	78,700	78,796	78,891	78,988	79,084
Lake	20,009	20,038	20,067	20,100	20,141	20,182	20,222	20,263	20,303	20,343	20,384
Lorain	24,166	24,190	24,246	24,284	24,336	24,389	24,441	24,494	24,544	24,598	24,651
Lucas	40,122	40,200	40,298	40,405	40,535	40,663	40,787	40,914	41,038	41,160	41,285
Mahoning	20,905	20,915	20,946	20,991	21,027	21,063	21,099	21,134	21,170	21,205	21,240
Medina	14,868	14,898	14,922	14,944	14,970	14,996	15,020	15,045	15,069	15,093	15,116
Miami	10,536	10,541	10,548	10,556	10,566	10,576	10,586	10,596	10,606	10,616	10,625
Summit	45,383	45,464	45,557	45,630	45,738	45,844	45,950	46,053	46,155	46,256	46,354

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.*

Ohio Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	4/17	4/18	4/19	4/20	4/22	4/24	4/26
Athens	5,015	5,024	5,038	5,070	5,101 (1,020) [245] {122}	5,135 (1,027) [246] {123}	5,171 (1,034) [248] {124}
Cuyahoga	107,043	107,210	107,459	107,687	108,260 (21,652) [5,196] {2,598}	108,836 (21,767) [5,224] {2,612}	109,408 (21,882) [5,252] {2,626}
Franklin	122,167	122,299	122,519	122,789	123,282 (24,656) [5,918] {2,959}	123,775 (24,755) [5,941] {2,971}	124,268 (24,854) [5,965] {2,982}
Hamilton	78,180	78,220	78,326	78,409	78,603 (15,721) [3,773] {1,886}	78,796 (15,759) [3,782] {1,891}	78,988 (15,798) [3,791] {1,896}
Lake	20,009	20,038	20,067	20,100	20,182 (4,036) [969] {484}	20,263 (4,053) [973] {486}	20,343 (4,069) [976] {488}
Lorain	24,166	24,190	24,246	24,284	24,389 (4,878) [1,171] {585}	24,494 (4,899) [1,176] {588}	24,598 (4,920) [1,181] {590}
Lucas	40,122	40,200	40,298	40,405	40,663 (8,133) [1,952] {976}	40,914 (8,183) [1,964] {982}	41,160 (8,232) [1,976] {988}
Mahoning	20,905	20,915	20,946	20,991	21,063 (4,213) [1,011] {506}	21,134 (4,227) [1,014] {507}	21,205 (4,241) [1,018] {509}
Medina	14,868	14,898	14,922	14,944	14,996 (2,999) [720] {360}	15,045 (3,009) [722] {361}	15,093 (3,019) [724] {362}
Miami	10,536	10,541	10,548	10,556	10,576 (2,115) [508] {254}	10,596 (2,119) [509] {254}	10,616 (2,123) [510] {255}
Summit	45,383	45,464	45,557	45,630	45,844 (9,169) [2,201] {1,100}	46,053 (9,211) [2,211] {1,105}	46,256 (9,251) [2,220] {1,110}

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.