IEM's AI Modeling: Short-term COVID-19 Projections
Date: 1/24/22

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 1/24/22 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
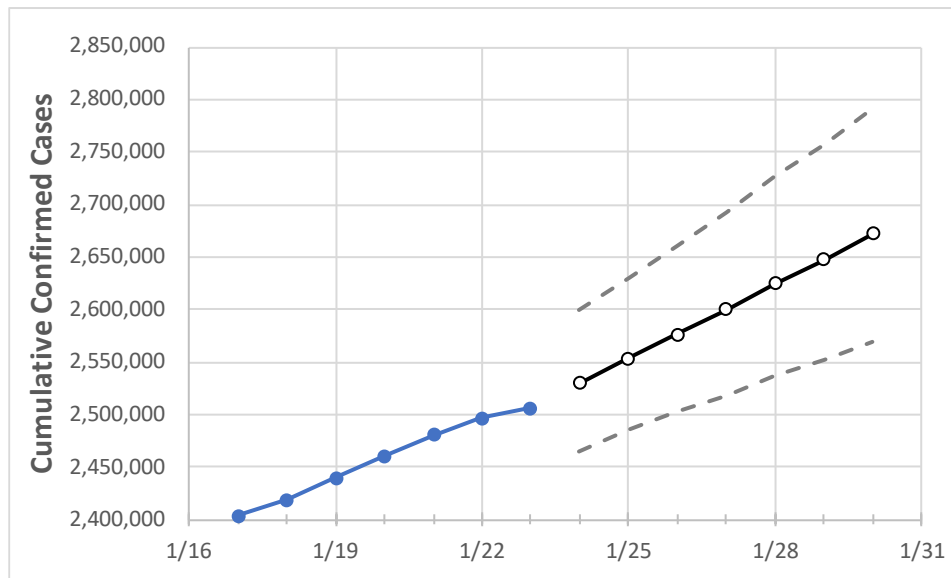
	Actual Confirmed Cases On:				Projected Cases For:						
	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30
Ohio	2,460,869	2,480,566	2,496,243	2,506,175	2,529,727	2,553,034	2,576,532	2,600,098	2,624,389	2,647,275	2,672,229

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:						
	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30
Athens	12,272	12,451	12,624	12,802	13,052	13,316	13,560	13,831	14,128	14,395	14,677
Cuyahoga	258,984	259,565	260,061	260,411	261,178	261,899	262,571	263,231	263,924	264,543	265,153
Franklin	266,068	267,977	269,677	270,793	273,525	276,264	278,809	281,579	284,124	286,996	289,619
Hamilton	171,129	172,998	174,264	175,147	177,276	179,314	181,414	183,456	185,682	187,829	189,804
Lake	47,212	47,351	47,462	47,530	47,686	47,843	47,989	48,136	48,274	48,419	48,540
Lorain	63,561	63,765	63,976	64,068	64,354	64,641	64,911	65,184	65,444	65,694	65,945
Lucas	91,746	92,448	92,912	93,285	94,339	95,425	96,546	97,636	98,694	99,881	100,946
Mahoning	50,412	50,752	50,955	51,094	51,491	51,845	52,229	52,599	52,963	53,367	53,710
Medina	38,036	38,323	38,487	38,556	38,752	38,939	39,117	39,292	39,461	39,632	39,789
Miami	23,567	23,785	23,931	24,086	24,390	24,698	25,007	25,339	25,665	26,030	26,349
Summit	107,780	108,161	108,496	108,737	109,236	109,702	110,124	110,575	111,025	111,413	111,828

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:		
	1/20	1/21	1/22	1/23	1/25	1/27	1/29
Athens	12,272	12,451	12,624	12,802	13,316 (2,663) [639] {320}	13,831 (2,766) [664] {332}	14,395 (2,879) [691] {345}
Cuyahoga	258,984	259,565	260,061	260,411	261,899 (52,380) [12,571] {6,286}	263,231 (52,646) [12,635] {6,318}	264,543 (52,909) [12,698] {6,349}
Franklin	266,068	267,977	269,677	270,793	276,264 (55,253) [13,261] {6,630}	281,579 (56,316) [13,516] {6,758}	286,996 (57,399) [13,776] {6,888}
Hamilton	171,129	172,998	174,264	175,147	179,314 (35,863) [8,607] {4,304}	183,456 (36,691) [8,806] {4,403}	187,829 (37,566) [9,016] {4,508}
Lake	47,212	47,351	47,462	47,530	47,843 (9,569) [2,296] {1,148}	48,136 (9,627) [2,311] {1,155}	48,419 (9,684) [2,324] {1,162}
Lorain	63,561	63,765	63,976	64,068	64,641 (12,928) [3,103] {1,551}	65,184 (13,037) [3,129] {1,564}	65,694 (13,139) [3,153] {1,577}
Lucas	91,746	92,448	92,912	93,285	95,425 (19,085) [4,580] {2,290}	97,636 (19,527) [4,687] {2,343}	99,881 (19,976) [4,794] {2,397}
Mahoning	50,412	50,752	50,955	51,094	51,845 (10,369) [2,489] {1,244}	52,599 (10,520) [2,525] {1,262}	53,367 (10,673) [2,562] {1,281}
Medina	38,036	38,323	38,487	38,556	38,939 (7,788) [1,869] {935}	39,292 (7,858) [1,886] {943}	39,632 (7,926) [1,902] {951}
Miami	23,567	23,785	23,931	24,086	24,698 (4,940) [1,185] {593}	25,339 (5,068) [1,216] {608}	26,030 (5,206) [1,249] {625}
Summit	107,780	108,161	108,496	108,737	109,702 (21,940) [5,266] {2,633}	110,575 (22,115) [5,308] {2,654}	111,413 (22,283) [5,348] {2,674}

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.