IEM's AI Modeling: Short-term COVID-19 Projections
Date: 11/22/21

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 11/22/21 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
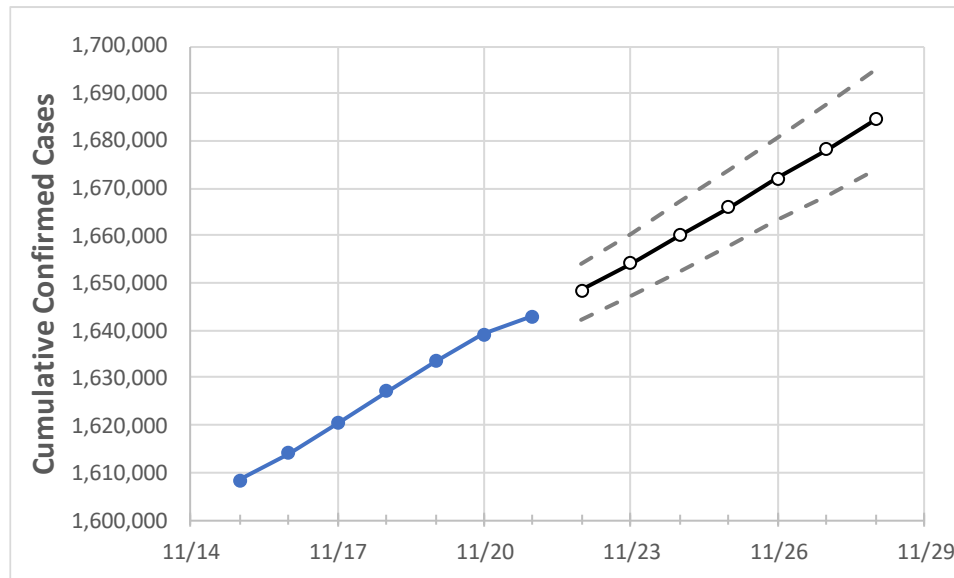
	Actual Confirmed Cases On:				Projected Cases For:						
	11/18	11/19	11/20	11/21	11/22	11/23	11/24	11/25	11/26	11/27	11/28
Ohio	1,627,051	1,633,480	1,639,070	1,642,867	1,648,499	1,654,245	1,660,055	1,666,041	1,672,041	1,678,227	1,684,443

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:						
	11/18	11/19	11/20	11/21	11/22	11/23	11/24	11/25	11/26	11/27	11/28
Athens	8,129	8,154	8,171	8,178	8,191	8,203	8,215	8,228	8,241	8,253	8,266
Cuyahoga	157,429	158,171	158,819	159,358	160,028	160,715	161,415	162,139	162,868	163,630	164,405
Franklin	172,227	172,756	173,126	173,422	173,841	174,264	174,692	175,125	175,573	176,032	176,482
Hamilton	109,978	110,262	110,497	110,637	110,874	111,106	111,339	111,581	111,827	112,083	112,330
Lake	29,689	29,898	30,110	30,262	30,442	30,628	30,820	31,020	31,227	31,435	31,649
Lorain	39,099	39,323	39,479	39,620	39,817	40,019	40,224	40,427	40,639	40,868	41,088
Lucas	59,997	60,176	60,382	60,525	60,708	60,892	61,081	61,269	61,462	61,660	61,854
Mahoning	33,543	33,710	33,855	33,954	34,109	34,263	34,419	34,580	34,745	34,917	35,086
Medina	24,141	24,271	24,368	24,446	24,561	24,678	24,797	24,918	25,041	25,168	25,297
Miami	16,653	16,691	16,729	16,748	16,790	16,832	16,874	16,918	16,961	17,005	17,048
Summit	66,954	67,368	67,709	67,937	68,274	68,616	68,965	69,330	69,699	70,079	70,468

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: | | |
	11/18	11/19	11/20	11/21	11/23	11/25	11/27
Athens	8,129	8,154	8,171	8,178	8,203 (1,641) [394] {197}	8,228 (1,646) [395] {197}	8,253 (1,651) [396] {198}
Cuyahoga	157,429	158,171	158,819	159,358	160,715 (32,143) [7,714] {3,857}	162,139 (32,428) [7,783] {3,891}	163,630 (32,726) [7,854] {3,927}
Franklin	172,227	172,756	173,126	173,422	174,264 (34,853) [8,365] {4,182}	175,125 (35,025) [8,406] {4,203}	176,032 (35,206) [8,450] {4,225}
Hamilton	109,978	110,262	110,497	110,637	111,106 (22,221) [5,333] {2,667}	111,581 (22,316) [5,356] {2,678}	112,083 (22,417) [5,380] {2,690}
Lake	29,689	29,898	30,110	30,262	30,628 (6,126) [1,470] {735}	31,020 (6,204) [1,489] {744}	31,435 (6,287) [1,509] {754}
Lorain	39,099	39,323	39,479	39,620	40,019 (8,004) [1,921] {960}	40,427 (8,085) [1,941] {970}	40,868 (8,174) [1,962] {981}
Lucas	59,997	60,176	60,382	60,525	60,892 (12,178) [2,923] {1,461}	61,269 (12,254) [2,941] {1,470}	61,660 (12,332) [2,960] {1,480}
Mahoning	33,543	33,710	33,855	33,954	34,263 (6,853) [1,645] {822}	34,580 (6,916) [1,660] {830}	34,917 (6,983) [1,676] {838}
Medina	24,141	24,271	24,368	24,446	24,678 (4,936) [1,185] {592}	24,918 (4,984) [1,196] {598}	25,168 (5,034) [1,208] {604}
Miami	16,653	16,691	16,729	16,748	16,832 (3,366) [808] {404}	16,918 (3,384) [812] {406}	17,005 (3,401) [816] {408}
Summit	66,954	67,368	67,709	67,937	68,616 (13,723) [3,294] {1,647}	69,330 (13,866) [3,328] {1,664}	70,079 (14,016) [3,364] {1,682}

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.