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

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 not 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 11/19/21 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
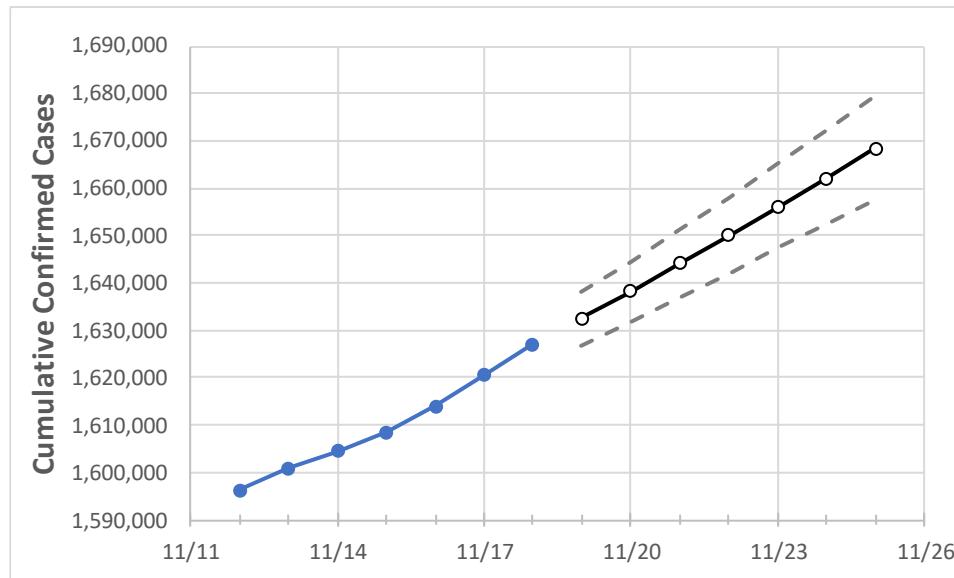
	Actual Confirmed Cases On:				Projected Cases For:						
	11/15	11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23	11/24	11/25
Ohio	1,608,415	1,614,054	1,620,436	1,627,051	1,632,623	1,638,274	1,644,069	1,649,994	1,655,877	1,662,167	1,668,344

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:						
	11/15	11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23	11/24	11/25
Athens	8,083	8,090	8,103	8,129	8,142	8,155	8,167	8,180	8,192	8,206	8,218
Cuyahoga	155,557	156,064	156,720	157,429	158,072	158,725	159,399	160,098	160,819	161,546	162,297
Franklin	170,832	171,284	171,786	172,227	172,629	173,036	173,447	173,878	174,307	174,754	175,191
Hamilton	109,220	109,404	109,699	109,978	110,205	110,436	110,670	110,911	111,151	111,403	111,649
Lake	29,190	29,326	29,510	29,689	29,840	29,996	30,155	30,318	30,490	30,660	30,837
Lorain	38,467	38,608	38,881	39,099	39,292	39,490	39,692	39,896	40,111	40,329	40,555
Lucas	59,376	59,553	59,815	59,997	60,172	60,350	60,528	60,715	60,899	61,091	61,277
Mahoning	33,059	33,212	33,354	33,543	33,696	33,851	34,006	34,169	34,337	34,508	34,679
Medina	23,801	23,913	24,013	24,141	24,259	24,378	24,499	24,623	24,753	24,885	25,018
Miami	16,495	16,553	16,595	16,653	16,699	16,746	16,794	16,842	16,891	16,940	16,990
Summit	66,084	66,336	66,597	66,954	67,252	67,566	67,889	68,214	68,549	68,900	69,260

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:		
	11/15	11/16	11/17	11/18	11/20	11/22	11/24
Athens	8,083	8,090	8,103	8,129	8,155 (1,631) [391] {196}	8,180 (1,636) [393] {196}	8,206 (1,641) [394] {197}
Cuyahoga	155,557	156,064	156,720	157,429	158,725 (31,745) [7,619] {3,809}	160,098 (32,020) [7,685] {3,842}	161,546 (32,309) [7,754] {3,877}
Franklin	170,832	171,284	171,786	172,227	173,036 (34,607) [8,306] {4,153}	173,878 (34,776) [8,346] {4,173}	174,754 (34,951) [8,388] {4,194}
Hamilton	109,220	109,404	109,699	109,978	110,436 (22,087) [5,301] {2,650}	110,911 (22,182) [5,324] {2,662}	111,403 (22,281) [5,347] {2,674}
Lake	29,190	29,326	29,510	29,689	29,996 (5,999) [1,440] {720}	30,318 (6,064) [1,455] {728}	30,660 (6,132) [1,472] {736}
Lorain	38,467	38,608	38,881	39,099	39,490 (7,898) [1,896] {948}	39,896 (7,979) [1,915] {957}	40,329 (8,066) [1,936] {968}
Lucas	59,376	59,553	59,815	59,997	60,350 (12,070) [2,897] {1,448}	60,715 (12,143) [2,914] {1,457}	61,091 (12,218) [2,932] {1,466}
Mahoning	33,059	33,212	33,354	33,543	33,851 (6,770) [1,625] {812}	34,169 (6,834) [1,640] {820}	34,508 (6,902) [1,656] {828}
Medina	23,801	23,913	24,013	24,141	24,378 (4,876) [1,170] {585}	24,623 (4,925) [1,182] {591}	24,885 (4,977) [1,194] {597}
Miami	16,495	16,553	16,595	16,653	16,746 (3,349) [804] {402}	16,842 (3,368) [808] {404}	16,940 (3,388) [813] {407}
Summit	66,084	66,336	66,597	66,954	67,566 (13,513) [3,243] {1,622}	68,214 (13,643) [3,274] {1,637}	68,900 (13,780) [3,307] {1,654}

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.