IEM's AI Modeling: Short-term COVID-19 Projections
Date: 11/12/21

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 11/12/21 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
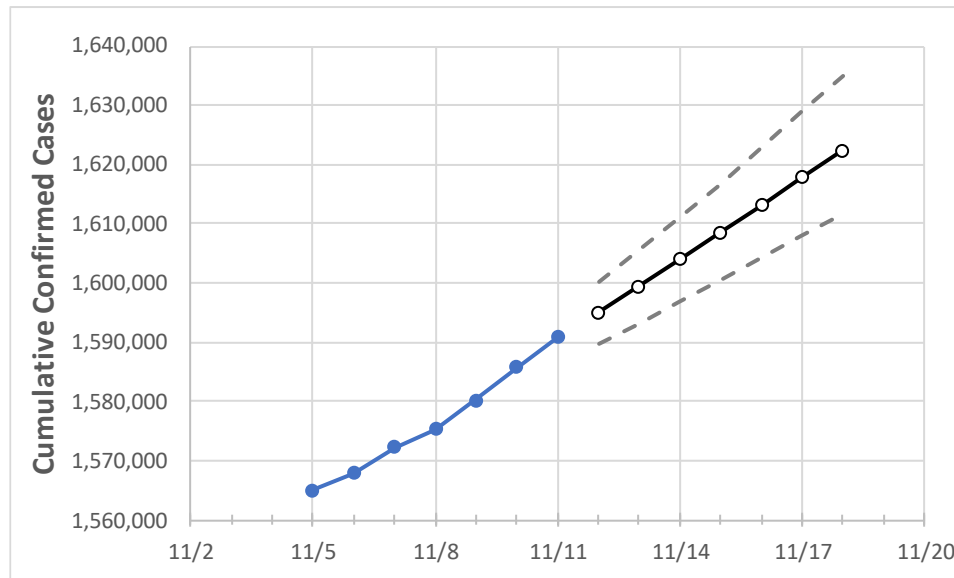
	Actual Confirmed Cases On:				Projected Cases For:						
	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15	11/16	11/17	11/18
Ohio	1,575,319	1,580,271	1,585,798	1,590,792	1,595,095	1,599,496	1,603,951	1,608,567	1,613,140	1,617,784	1,622,460

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:						
	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15	11/16	11/17	11/18
Athens	8,018	8,022	8,026	8,040	8,053	8,064	8,076	8,088	8,100	8,112	8,123
Cuyahoga	151,850	152,302	152,827	153,372	153,890	154,433	154,992	155,571	156,164	156,789	157,417
Franklin	168,363	168,728	169,123	169,534	169,831	170,142	170,450	170,762	171,077	171,391	171,696
Hamilton	107,870	108,024	108,240	108,456	108,639	108,826	109,011	109,196	109,383	109,578	109,764
Lake	28,348	28,468	28,590	28,713	28,817	28,923	29,032	29,141	29,254	29,367	29,482
Lorain	37,425	37,537	37,734	37,842	37,977	38,109	38,247	38,385	38,526	38,671	38,812
Lucas	58,289	58,436	58,662	58,812	58,950	59,085	59,224	59,364	59,502	59,648	59,788
Mahoning	32,140	32,295	32,432	32,575	32,688	32,801	32,915	33,035	33,155	33,276	33,396
Medina	23,108	23,193	23,315	23,413	23,503	23,592	23,682	23,776	23,872	23,970	24,066
Miami	16,178	16,228	16,274	16,330	16,370	16,410	16,449	16,490	16,530	16,571	16,611
Summit	64,247	64,536	64,741	64,983	65,179	65,379	65,580	65,786	65,997	66,215	66,425

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: | | |
	11/8	11/9	11/10	11/11	11/13	11/15	11/17
Athens	8,018	8,022	8,026	8,040	8,064 (1,613) [387] {194}	8,088 (1,618) [388] {194}	8,112 (1,622) [389] {195}
Cuyahoga	151,850	152,302	152,827	153,372	154,433 (30,887) [7,413] {3,706}	155,571 (31,114) [7,467] {3,734}	156,789 (31,358) [7,526] {3,763}
Franklin	168,363	168,728	169,123	169,534	170,142 (34,028) [8,167] {4,083}	170,762 (34,152) [8,197] {4,098}	171,391 (34,278) [8,227] {4,113}
Hamilton	107,870	108,024	108,240	108,456	108,826 (21,765) [5,224] {2,612}	109,196 (21,839) [5,241] {2,621}	109,578 (21,916) [5,260] {2,630}
Lake	28,348	28,468	28,590	28,713	28,923 (5,785) [1,388] {694}	29,141 (5,828) [1,399] {699}	29,367 (5,873) [1,410] {705}
Lorain	37,425	37,537	37,734	37,842	38,109 (7,622) [1,829] {915}	38,385 (7,677) [1,843] {921}	38,671 (7,734) [1,856] {928}
Lucas	58,289	58,436	58,662	58,812	59,085 (11,817) [2,836] {1,418}	59,364 (11,873) [2,849] {1,425}	59,648 (11,930) [2,863] {1,432}
Mahoning	32,140	32,295	32,432	32,575	32,801 (6,560) [1,574] {787}	33,035 (6,607) [1,586] {793}	33,276 (6,655) [1,597] {799}
Medina	23,108	23,193	23,315	23,413	23,592 (4,718) [1,132] {566}	23,776 (4,755) [1,141] {571}	23,970 (4,794) [1,151] {575}
Miami	16,178	16,228	16,274	16,330	16,410 (3,282) [788] {394}	16,490 (3,298) [792] {396}	16,571 (3,314) [795] {398}
Summit	64,247	64,536	64,741	64,983	65,379 (13,076) [3,138] {1,569}	65,786 (13,157) [3,158] {1,579}	66,215 (13,243) [3,178] {1,589}

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.