IEM's AI Modeling: Short-term COVID-19 Projections

Date: 1/26/21

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 1/26/21 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.

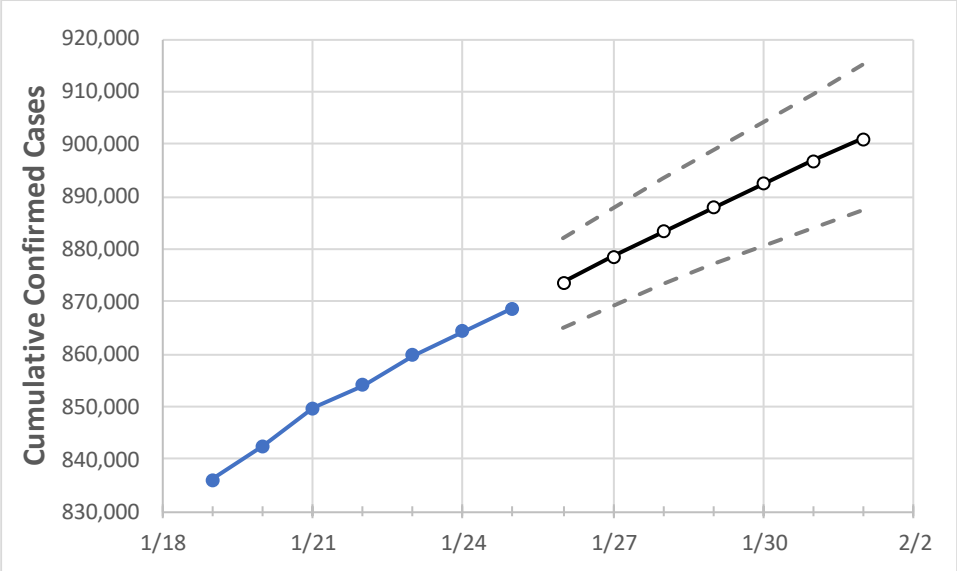
IEM's Modeling Lead

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:						
	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1
Ohio	853,982	859,841	864,322	868,656	873,691	878,598	883,285	887,864	892,326	896,702	900,974

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:						
	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1
Athens	3,766	3,800	3,812	3,838	3,865	3,893	3,919	3,946	3,973	3,999	4,025
Cuyahoga	84,960	85,571	86,066	86,520	87,036	87,552	88,057	88,558	89,037	89,508	89,964
Franklin	100,550	101,171	101,705	102,154	102,717	103,263	103,794	104,311	104,819	105,314	105,809
Hamilton	63,509	64,017	64,392	64,744	65,209	65,655	66,107	66,546	66,985	67,418	67,841
Lake	15,967	16,080	16,178	16,250	16,358	16,462	16,562	16,660	16,756	16,848	16,938
Lorain	18,847	19,017	19,165	19,296	19,442	19,590	19,735	19,880	20,022	20,158	20,298
Lucas	31,151	31,350	31,500	31,663	31,847	32,028	32,203	32,380	32,558	32,732	32,908
Mahoning	17,215	17,321	17,383	17,471	17,555	17,639	17,719	17,799	17,878	17,955	18,031
Medina	11,504	11,591	11,666	11,732	11,805	11,876	11,945	12,014	12,082	12,147	12,210
Miami	9,113	9,168	9,210	9,244	9,294	9,342	9,388	9,435	9,480	9,523	9,567
Summit	34,586	34,836	35,063	35,250	35,471	35,687	35,893	36,095	36,289	36,478	36,660

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:		
	1/22	1/23	1/24	1/25	1/27	1/29	1/31
Athens	3,766	3,800	3,812	3,838	3,893 (779) [187] {93}	3,946 (789) [189] {95}	3,999 (800) [192] {96}
Cuyahoga	84,960	85,571	86,066	86,520	87,552 (17,510) [4,203] {2,101}	88,558 (17,712) [4,251] {2,125}	89,508 (17,902) [4,296] {2,148}
Franklin	100,550	101,171	101,705	102,154	103,263 (20,653) [4,957] {2,478}	104,311 (20,862) [5,007] {2,503}	105,314 (21,063) [5,055] {2,528}
Hamilton	63,509	64,017	64,392	64,744	65,655 (13,131) [3,151] {1,576}	66,546 (13,309) [3,194] {1,597}	67,418 (13,484) [3,236] {1,618}
Lake	15,967	16,080	16,178	16,250	16,462 (3,292) [790] {395}	16,660 (3,332) [800] {400}	16,848 (3,370) [809] {404}
Lorain	18,847	19,017	19,165	19,296	19,590 (3,918) [940] {470}	19,880 (3,976) [954] {477}	20,158 (4,032) [968] {484}
Lucas	31,151	31,350	31,500	31,663	32,028 (6,406) [1,537] {769}	32,380 (6,476) [1,554] {777}	32,732 (6,546) [1,571] {786}
Mahoning	17,215	17,321	17,383	17,471	17,639 (3,528) [847] {423}	17,799 (3,560) [854] {427}	17,955 (3,591) [862] {431}
Medina	11,504	11,591	11,666	11,732	11,876 (2,375) [570] {285}	12,014 (2,403) [577] {288}	12,147 (2,429) [583] {292}
Miami	9,113	9,168	9,210	9,244	9,342 (1,868) [448] {224}	9,435 (1,887) [453] {226}	9,523 (1,905) [457] {229}
Summit	34,586	34,836	35,063	35,250	35,687 (7,137) [1,713] {856}	36,095 (7,219) [1,733] {866}	36,478 (7,296) [1,751] {875}

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.