IEM's AI Modeling: Short-term COVID-19 Projections
Date: 1/25/21

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 1/25/21 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.
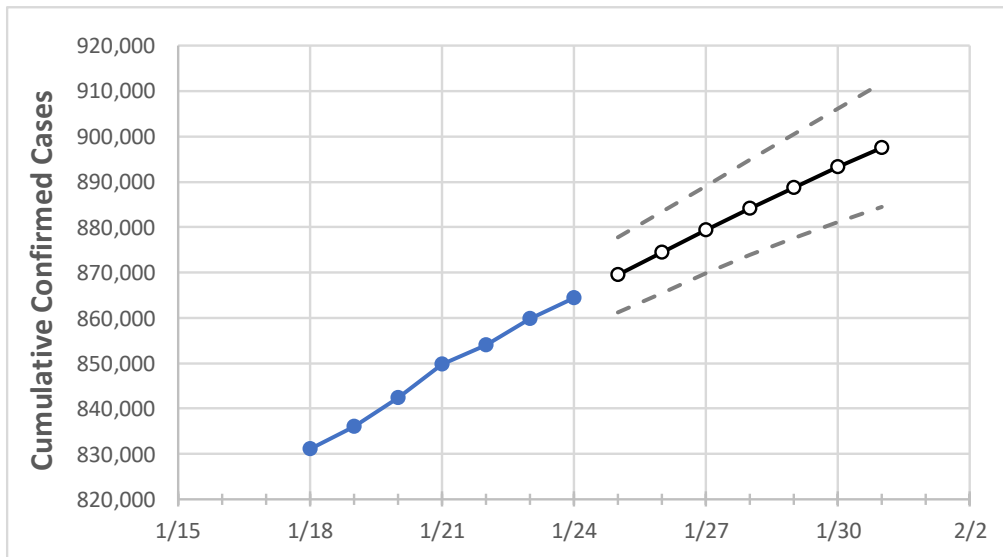
IEM's Modeling Lead

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:						
	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31
Ohio	849,704	853,982	859,841	864,322	869,478	874,471	879,372	884,065	888,693	893,220	897,452

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:						
	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31
Athens	3,737	3,766	3,800	3,812	3,840	3,867	3,895	3,921	3,947	3,974	4,000
Cuyahoga	84,523	84,960	85,571	86,066	86,636	87,184	87,727	88,271	88,802	89,316	89,840
Franklin	100,046	100,550	101,171	101,705	102,317	102,925	103,513	104,091	104,653	105,206	105,754
Hamilton	63,092	63,509	64,017	64,392	64,871	65,348	65,812	66,271	66,738	67,198	67,648
Lake	15,882	15,967	16,080	16,178	16,292	16,402	16,513	16,622	16,727	16,831	16,933
Lorain	18,767	18,847	19,017	19,165	19,321	19,472	19,619	19,767	19,915	20,058	20,202
Lucas	31,041	31,151	31,350	31,500	31,691	31,883	32,071	32,260	32,442	32,620	32,798
Mahoning	17,163	17,215	17,321	17,383	17,470	17,554	17,640	17,724	17,805	17,884	17,964
Medina	11,439	11,504	11,591	11,666	11,743	11,817	11,890	11,960	12,029	12,097	12,162
Miami	9,073	9,113	9,168	9,210	9,259	9,308	9,355	9,401	9,444	9,487	9,530
Summit	34,405	34,586	34,836	35,063	35,317	35,578	35,833	36,087	36,329	36,574	36,813

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: | | |
	1/21	1/22	1/23	1/24	1/26	1/28	1/30
Athens	3,737	3,766	3,800	3,812	3,867 (773) [186] {93}	3,921 (784) [188] {94}	3,974 (795) [191] {95}
Cuyahoga	84,523	84,960	85,571	86,066	87,184 (17,437) [4,185] {2,092}	88,271 (17,654) [4,237] {2,119}	89,316 (17,863) [4,287] {2,144}
Franklin	100,046	100,550	101,171	101,705	102,925 (20,585) [4,940] {2,470}	104,091 (20,818) [4,996] {2,498}	105,206 (21,041) [5,050] {2,525}
Hamilton	63,092	63,509	64,017	64,392	65,348 (13,070) [3,137] {1,568}	66,271 (13,254) [3,181] {1,590}	67,198 (13,440) [3,226] {1,613}
Lake	15,882	15,967	16,080	16,178	16,402 (3,280) [787] {394}	16,622 (3,324) [798] {399}	16,831 (3,366) [808] {404}
Lorain	18,767	18,847	19,017	19,165	19,472 (3,894) [935] {467}	19,767 (3,953) [949] {474}	20,058 (4,012) [963] {481}
Lucas	31,041	31,151	31,350	31,500	31,883 (6,377) [1,530] {765}	32,260 (6,452) [1,548] {774}	32,620 (6,524) [1,566] {783}
Mahoning	17,163	17,215	17,321	17,383	17,554 (3,511) [843] {421}	17,724 (3,545) [851] {425}	17,884 (3,577) [858] {429}
Medina	11,439	11,504	11,591	11,666	11,817 (2,363) [567] {284}	11,960 (2,392) [574] {287}	12,097 (2,419) [581] {290}
Miami	9,073	9,113	9,168	9,210	9,308 (1,862) [447] {223}	9,401 (1,880) [451] {226}	9,487 (1,897) [455] {228}
Summit	34,405	34,586	34,836	35,063	35,578 (7,116) [1,708] {854}	36,087 (7,217) [1,732] {866}	36,574 (7,315) [1,756] {878}

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.