IEM's AI Modeling: Short-term COVID-19 Projections
Date: 1/20/21

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 1/20/21 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
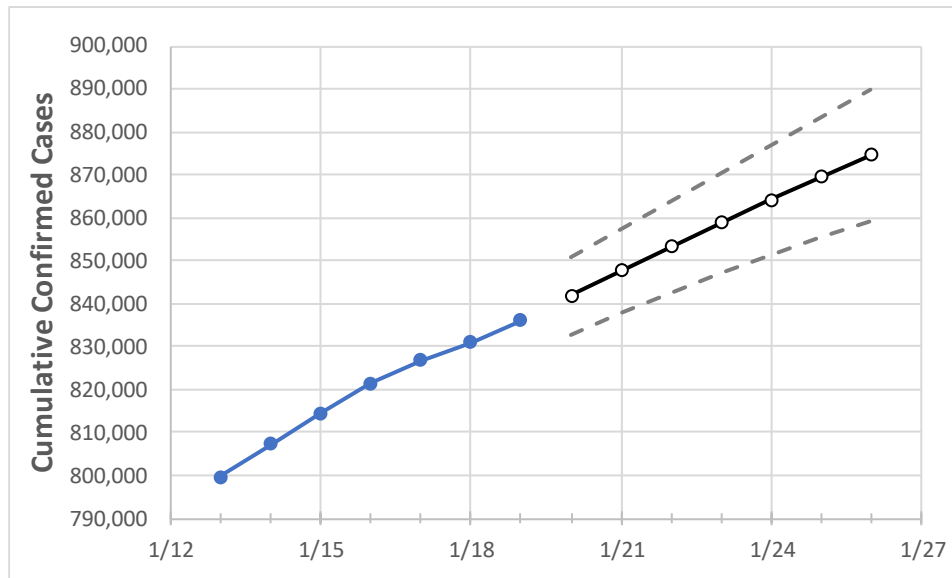
	Actual Confirmed Cases On:				Projected Cases For:						
	1/16	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26
Ohio	821,507	826,754	831,066	836,049	841,957	847,745	853,366	858,878	864,283	869,535	874,709

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:						
	1/16	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26
Athens	3,622	3,636	3,654	3,675	3,705	3,735	3,764	3,794	3,823	3,852	3,882
Cuyahoga	81,526	82,178	82,613	83,180	83,798	84,398	84,996	85,583	86,161	86,735	87,302
Franklin	96,935	97,493	97,996	98,533	99,208	99,887	100,546	101,210	101,851	102,486	103,104
Hamilton	60,913	61,350	61,629	61,931	62,451	62,963	63,471	63,975	64,469	64,966	65,449
Lake	15,255	15,365	15,491	15,592	15,723	15,854	15,983	16,108	16,231	16,354	16,474
Lorain	17,916	18,086	18,217	18,418	18,600	18,776	18,954	19,132	19,310	19,489	19,664
Lucas	29,981	30,111	30,316	30,524	30,760	30,996	31,224	31,451	31,681	31,903	32,124
Mahoning	16,710	16,758	16,815	16,931	17,026	17,123	17,219	17,312	17,407	17,497	17,584
Medina	11,033	11,128	11,191	11,286	11,386	11,486	11,583	11,679	11,770	11,862	11,955
Miami	8,801	8,865	8,905	8,952	9,017	9,080	9,142	9,203	9,265	9,325	9,383
Summit	33,096	33,399	33,603	33,849	34,157	34,464	34,773	35,079	35,385	35,684	35,984

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:		
	1/16	1/17	1/18	1/19	1/21	1/23	1/25
Athens	3,622	3,636	3,654	3,675	3,735 (747) [179] {90}	3,794 (759) [182] {91}	3,852 (770) [185] {92}
Cuyahoga	81,526	82,178	82,613	83,180	84,398 (16,880) [4,051] {2,026}	85,583 (17,117) [4,108] {2,054}	86,735 (17,347) [4,163] {2,082}
Franklin	96,935	97,493	97,996	98,533	99,887 (19,977) [4,795] {2,397}	101,210 (20,242) [4,858] {2,429}	102,486 (20,497) [4,919] {2,460}
Hamilton	60,913	61,350	61,629	61,931	62,963 (12,593) [3,022] {1,511}	63,975 (12,795) [3,071] {1,535}	64,966 (12,993) [3,118] {1,559}
Lake	15,255	15,365	15,491	15,592	15,854 (3,171) [761] {380}	16,108 (3,222) [773] {387}	16,354 (3,271) [785] {392}
Lorain	17,916	18,086	18,217	18,418	18,776 (3,755) [901] {451}	19,132 (3,826) [918] {459}	19,489 (3,898) [935] {468}
Lucas	29,981	30,111	30,316	30,524	30,996 (6,199) [1,488] {744}	31,451 (6,290) [1,510] {755}	31,903 (6,381) [1,531] {766}
Mahoning	16,710	16,758	16,815	16,931	17,123 (3,425) [822] {411}	17,312 (3,462) [831] {415}	17,497 (3,499) [840] {420}
Medina	11,033	11,128	11,191	11,286	11,486 (2,297) [551] {276}	11,679 (2,336) [561] {280}	11,862 (2,372) [569] {285}
Miami	8,801	8,865	8,905	8,952	9,080 (1,816) [436] {218}	9,203 (1,841) [442] {221}	9,325 (1,865) [448] {224}
Summit	33,096	33,399	33,603	33,849	34,464 (6,893) [1,654] {827}	35,079 (7,016) [1,684] {842}	35,684 (7,137) [1,713] {856}

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.