IEM's AI Modeling: Short-term COVID-19 Projections
Date: 3/22/21

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 3/22/21 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
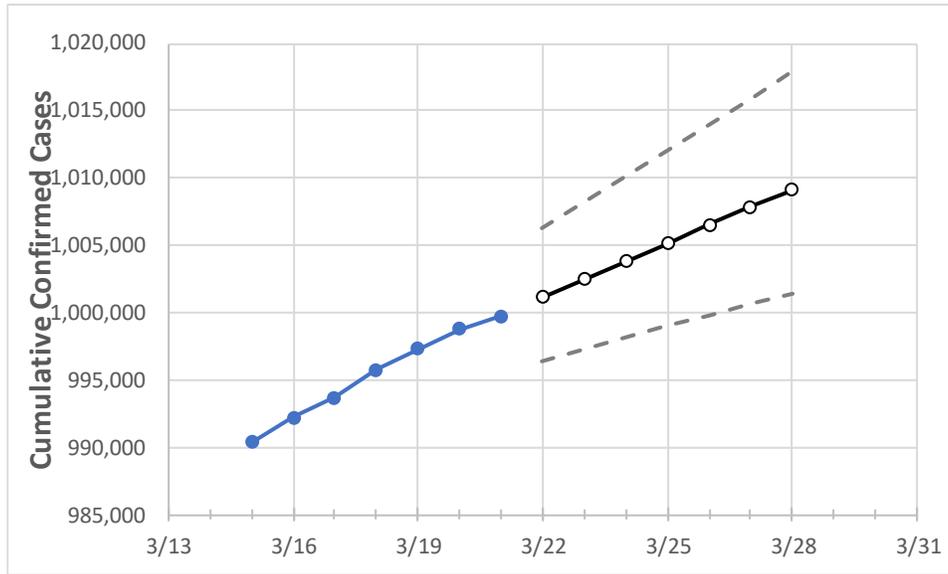
	Actual Confirmed Cases On:				Projected Cases For:						
	3/18	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28
Ohio	995,785	997,336	998,819	999,750	1,001,111	1,002,471	1,003,834	1,005,168	1,006,524	1,007,839	1,009,127

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:						
	3/18	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28
Athens	4,740	4,743	4,750	4,753	4,758	4,764	4,769	4,775	4,780	4,785	4,790
Cuyahoga	99,155	99,332	99,528	99,616	99,792	99,966	100,142	100,317	100,487	100,657	100,827
Franklin	115,083	115,261	115,433	115,553	115,720	115,888	116,054	116,216	116,380	116,545	116,706
Hamilton	75,093	75,212	75,305	75,383	75,473	75,566	75,658	75,748	75,836	75,925	76,012
Lake	18,893	18,914	18,930	18,946	18,968	18,989	19,010	19,031	19,050	19,069	19,088
Lorain	22,600	22,637	22,679	22,703	22,733	22,763	22,791	22,820	22,848	22,876	22,902
Lucas	36,651	36,728	36,804	36,838	36,902	36,964	37,026	37,088	37,148	37,208	37,268
Mahoning	19,828	19,865	19,892	19,914	19,934	19,954	19,974	19,993	20,012	20,031	20,049
Medina	13,969	13,991	14,018	14,037	14,070	14,105	14,141	14,174	14,207	14,242	14,277
Miami	10,183	10,196	10,201	10,208	10,218	10,227	10,237	10,247	10,257	10,267	10,277
Summit	41,795	41,904	41,997	42,065	42,163	42,263	42,361	42,459	42,557	42,658	42,759

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:		
	3/18	3/19	3/20	3/21	3/23	3/25	3/27
Athens	4,740	4,743	4,750	4,753	4,764 (953) [229] {114}	4,775 (955) [229] {115}	4,785 (957) [230] {115}
Cuyahoga	99,155	99,332	99,528	99,616	99,966 (19,993) [4,798] {2,399}	100,317 (20,063) [4,815] {2,408}	100,657 (20,131) [4,832] {2,416}
Franklin	115,083	115,261	115,433	115,553	115,888 (23,178) [5,563] {2,781}	116,216 (23,243) [5,578] {2,789}	116,545 (23,309) [5,594] {2,797}
Hamilton	75,093	75,212	75,305	75,383	75,566 (15,113) [3,627] {1,814}	75,748 (15,150) [3,636] {1,818}	75,925 (15,185) [3,644] {1,822}
Lake	18,893	18,914	18,930	18,946	18,989 (3,798) [911] {456}	19,031 (3,806) [913] {457}	19,069 (3,814) [915] {458}
Lorain	22,600	22,637	22,679	22,703	22,763 (4,553) [1,093] {546}	22,820 (4,564) [1,095] {548}	22,876 (4,575) [1,098] {549}
Lucas	36,651	36,728	36,804	36,838	36,964 (7,393) [1,774] {887}	37,088 (7,418) [1,780] {890}	37,208 (7,442) [1,786] {893}
Mahoning	19,828	19,865	19,892	19,914	19,954 (3,991) [958] {479}	19,993 (3,999) [960] {480}	20,031 (4,006) [961] {481}
Medina	13,969	13,991	14,018	14,037	14,105 (2,821) [677] {339}	14,174 (2,835) [680] {340}	14,242 (2,848) [684] {342}
Miami	10,183	10,196	10,201	10,208	10,227 (2,045) [491] {245}	10,247 (2,049) [492] {246}	10,267 (2,053) [493] {246}
Summit	41,795	41,904	41,997	42,065	42,263 (8,453) [2,029] {1,014}	42,459 (8,492) [2,038] {1,019}	42,658 (8,532) [2,048] {1,024}

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.