IEM's AI Modeling: Short-term COVID-19 Projections
Date: 3/25/22

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 3/25/22 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
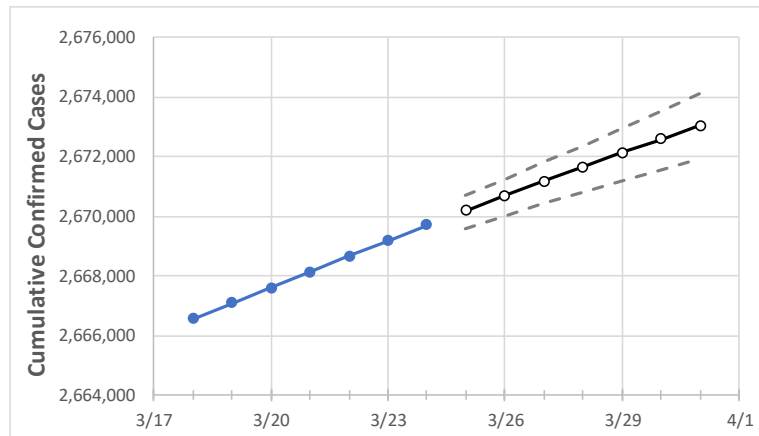
	Actual Confirmed Cases On:				Projected Cases For:						
	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	3/31
Ohio	2,668,126	2,668,650	2,669,174	2,669,698	2,670,193	2,670,685	2,671,180	2,671,649	2,672,120	2,672,591	2,673,051

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:						
	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	3/31
Athens	14,451	14,458	14,464	14,471	14,478	14,485	14,492	14,499	14,506	14,513	14,519
Cuyahoga	267,636	267,683	267,729	267,776	267,819	267,862	267,906	267,948	267,990	268,032	268,073
Franklin	287,719	287,788	287,857	287,926	287,994	288,062	288,129	288,196	288,263	288,330	288,397
Hamilton	186,937	186,997	187,057	187,117	187,168	187,220	187,273	187,325	187,376	187,430	187,481
Lake	48,755	48,763	48,771	48,779	48,787	48,795	48,804	48,812	48,820	48,828	48,836
Lorain	66,364	66,377	66,391	66,404	66,414	66,424	66,433	66,443	66,453	66,462	66,472
Lucas	99,540	99,566	99,591	99,617	99,638	99,659	99,678	99,697	99,716	99,735	99,752
Mahoning	53,246	53,253	53,260	53,267	53,275	53,282	53,290	53,298	53,306	53,314	53,322
Medina	39,934	39,941	39,948	39,955	39,962	39,969	39,976	39,983	39,989	39,996	40,003
Miami	25,677	25,679	25,680	25,682	25,683	25,684	25,686	25,687	25,688	25,689	25,690
Summit	111,938	111,951	111,963	111,976	111,988	111,999	112,010	112,021	112,031	112,042	112,053

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:		
	3/21	3/22	3/23	3/24	3/26	3/28	3/30
Athens	14,451	14,458	14,464	14,471	14,485 (2,897) [695] {348}	14,499 (2,900) [696] {348}	14,513 (2,903) [697] {348}
Cuyahoga	267,636	267,683	267,729	267,776	267,862 (53,572) [12,857] {6,429}	267,948 (53,590) [12,862] {6,431}	268,032 (53,606) [12,866] {6,433}
Franklin	287,719	287,788	287,857	287,926	288,062 (57,612) [13,827] {6,913}	288,196 (57,639) [13,833] {6,917}	288,330 (57,666) [13,840] {6,920}
Hamilton	186,937	186,997	187,057	187,117	187,220 (37,444) [8,987] {4,493}	187,325 (37,465) [8,992] {4,496}	187,430 (37,486) [8,997] {4,498}
Lake	48,755	48,763	48,771	48,779	48,795 (9,759) [2,342] {1,171}	48,812 (9,762) [2,343] {1,171}	48,828 (9,766) [2,344] {1,172}
Lorain	66,364	66,377	66,391	66,404	66,424 (13,285) [3,188] {1,594}	66,443 (13,289) [3,189] {1,595}	66,462 (13,292) [3,190] {1,595}
Lucas	99,540	99,566	99,591	99,617	99,659 (19,932) [4,784] {2,392}	99,697 (19,939) [4,785] {2,393}	99,735 (19,947) [4,787] {2,394}
Mahoning	53,246	53,253	53,260	53,267	53,282 (10,656) [2,558] {1,279}	53,298 (10,660) [2,558] {1,279}	53,314 (10,663) [2,559] {1,280}
Medina	39,934	39,941	39,948	39,955	39,969 (7,994) [1,918] {959}	39,983 (7,997) [1,919] {960}	39,996 (7,999) [1,920] {960}
Miami	25,677	25,679	25,680	25,682	25,684 (5,137) [1,233] {616}	25,687 (5,137) [1,233] {616}	25,689 (5,138) [1,233] {617}
Summit	111,938	111,951	111,963	111,976	111,999 (22,400) [5,376] {2,688}	112,021 (22,404) [5,377] {2,688}	112,042 (22,408) [5,378] {2,689}

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.