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

Date: 3/29/22

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 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 3/29/22 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.

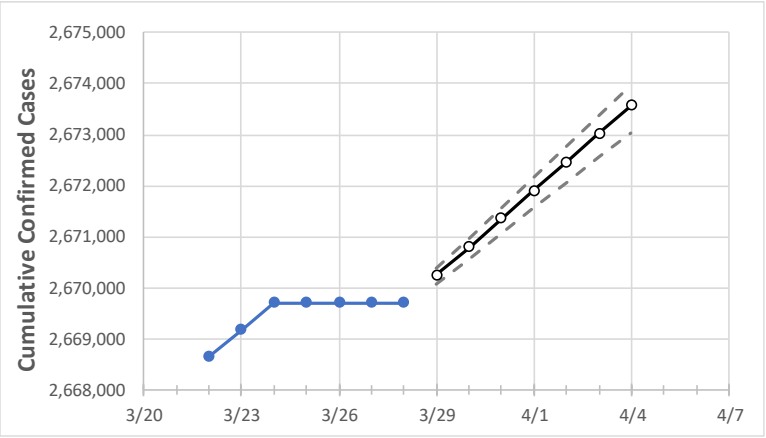
IEM's Modeling Lead

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:						
	3/25	3/26	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4
Ohio	2,669,698	2,669,698	2,669,698	2,669,698	2,670,246	2,670,798	2,671,351	2,671,907	2,672,463	2,673,018	2,673,572

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:						
	3/25	3/26	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4
Athens	14,471	14,471	14,471	14,471	14,478	14,485	14,492	14,499	14,507	14,514	14,521
Cuyahoga	267,776	267,776	267,776	267,776	267,822	267,869	267,916	267,963	268,010	268,057	268,104
Franklin	287,926	287,926	287,926	287,926	287,992	288,058	288,124	288,189	288,254	288,319	288,383
Hamilton	187,117	187,117	187,117	187,117	187,173	187,231	187,290	187,346	187,404	187,464	187,523
Lake	48,779	48,779	48,779	48,779	48,787	48,795	48,802	48,810	48,817	48,825	48,833
Lorain	66,404	66,404	66,404	66,404	66,415	66,427	66,438	66,450	66,461	66,473	66,484
Lucas	99,617	99,617	99,617	99,617	99,645	99,673	99,702	99,731	99,761	99,790	99,820
Mahoning	53,267	53,267	53,267	53,267	53,275	53,283	53,292	53,300	53,309	53,318	53,326
Medina	39,955	39,955	39,955	39,955	39,962	39,969	39,976	39,983	39,991	39,998	40,005
Miami	25,682	25,682	25,682	25,682	25,683	25,684	25,686	25,687	25,688	25,689	25,690
Summit	111,976	111,976	111,976	111,976	111,989	112,001	112,013	112,026	112,038	112,050	112,062

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:		
	3/25	3/26	3/27	3/28	3/30	4/1	4/3
Athens	14,471	14,471	14,471	14,471	14,485 (2,897) [695] {348}	14,499 (2,900) [696] {348}	14,514 (2,903) [697] {348}
Cuyahoga	267,776	267,776	267,776	267,776	267,869 (53,574) [12,858] {6,429}	267,963 (53,593) [12,862] {6,431}	268,057 (53,611) [12,867] {6,433}
Franklin	287,926	287,926	287,926	287,926	288,058 (57,612) [13,827] {6,913}	288,189 (57,638) [13,833] {6,917}	288,319 (57,664) [13,839] {6,920}
Hamilton	187,117	187,117	187,117	187,117	187,231 (37,446) [8,987] {4,494}	187,346 (37,469) [8,993] {4,496}	187,464 (37,493) [8,998] {4,499}
Lake	48,779	48,779	48,779	48,779	48,795 (9,759) [2,342] {1,171}	48,810 (9,762) [2,343] {1,171}	48,825 (9,765) [2,344] {1,172}
Lorain	66,404	66,404	66,404	66,404	66,427 (13,285) [3,188] {1,594}	66,450 (13,290) [3,190] {1,595}	66,473 (13,295) [3,191] {1,595}
Lucas	99,617	99,617	99,617	99,617	99,673 (19,935) [4,784] {2,392}	99,731 (19,946) [4,787] {2,394}	99,790 (19,958) [4,790] {2,395}
Mahoning	53,267	53,267	53,267	53,267	53,283 (10,657) [2,558] {1,279}	53,300 (10,660) [2,558] {1,279}	53,318 (10,664) [2,559] {1,280}
Medina	39,955	39,955	39,955	39,955	39,969 (7,994) [1,919] {959}	39,983 (7,997) [1,919] {960}	39,998 (8,000) [1,920] {960}
Miami	25,682	25,682	25,682	25,682	25,684 (5,137) [1,233] {616}	25,687 (5,137) [1,233] {616}	25,689 (5,138) [1,233] {617}
Summit	111,976	111,976	111,976	111,976	112,001 (22,400) [5,376] {2,688}	112,026 (22,405) [5,377] {2,689}	112,050 (22,410) [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.