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

Date: 3/18/22

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 3/18/22 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.

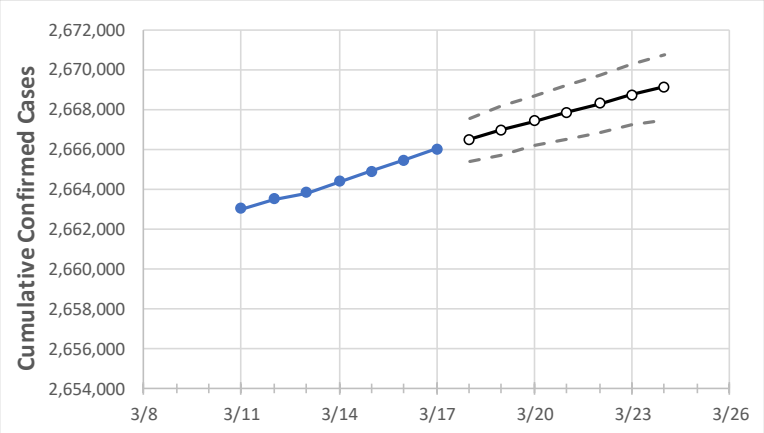
IEM's Modeling Lead

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:						
	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23	3/24
Ohio	2,664,384	2,664,933	2,665,481	2,666,030	2,666,520	2,666,998	2,667,453	2,667,894	2,668,343	2,668,773	2,669,179

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:						
	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23	3/24
Athens	14,407	14,413	14,419	14,425	14,430	14,435	14,440	14,444	14,449	14,454	14,458
Cuyahoga	267,301	267,351	267,400	267,450	267,496	267,541	267,586	267,627	267,671	267,714	267,754
Franklin	287,223	287,296	287,370	287,443	287,498	287,551	287,602	287,653	287,703	287,750	287,798
Hamilton	186,584	186,621	186,659	186,696	186,738	186,778	186,816	186,854	186,893	186,931	186,968
Lake	48,691	48,702	48,712	48,723	48,731	48,738	48,745	48,752	48,759	48,766	48,773
Lorain	66,296	66,301	66,306	66,311	66,317	66,323	66,328	66,333	66,339	66,344	66,349
Lucas	99,364	99,389	99,413	99,438	99,468	99,499	99,527	99,555	99,584	99,612	99,639
Mahoning	53,198	53,204	53,211	53,217	53,224	53,230	53,236	53,241	53,247	53,253	53,258
Medina	39,890	39,895	39,901	39,906	39,911	39,916	39,921	39,926	39,930	39,935	39,939
Miami	25,666	25,668	25,669	25,671	25,673	25,675	25,677	25,679	25,681	25,682	25,684
Summit	111,846	111,860	111,873	111,887	111,899	111,911	111,922	111,933	111,945	111,955	111,965

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:		
	3/14	3/15	3/16	3/17	3/19	3/21	3/23
Athens	14,407	14,413	14,419	14,425	14,435 (2,887) [693] {346}	14,444 (2,889) [693] {347}	14,454 (2,891) [694] {347}
Cuyahoga	267,301	267,351	267,400	267,450	267,541 (53,508) [12,842] {6,421}	267,627 (53,525) [12,846] {6,423}	267,714 (53,543) [12,850] {6,425}
Franklin	287,223	287,296	287,370	287,443	287,551 (57,510) [13,802] {6,901}	287,653 (57,531) [13,807] {6,904}	287,750 (57,550) [13,812] {6,906}
Hamilton	186,584	186,621	186,659	186,696	186,778 (37,356) [8,965] {4,483}	186,854 (37,371) [8,969] {4,485}	186,931 (37,386) [8,973] {4,486}
Lake	48,691	48,702	48,712	48,723	48,738 (9,748) [2,339] {1,170}	48,752 (9,750) [2,340] {1,170}	48,766 (9,753) [2,341] {1,170}
Lorain	66,296	66,301	66,306	66,311	66,323 (13,265) [3,183] {1,592}	66,333 (13,267) [3,184] {1,592}	66,344 (13,269) [3,185] {1,592}
Lucas	99,364	99,389	99,413	99,438	99,499 (19,900) [4,776] {2,388}	99,555 (19,911) [4,779] {2,389}	99,612 (19,922) [4,781] {2,391}
Mahoning	53,198	53,204	53,211	53,217	53,230 (10,646) [2,555] {1,278}	53,241 (10,648) [2,556] {1,278}	53,253 (10,651) [2,556] {1,278}
Medina	39,890	39,895	39,901	39,906	39,916 (7,983) [1,916] {958}	39,926 (7,985) [1,916] {958}	39,935 (7,987) [1,917] {958}
Miami	25,666	25,668	25,669	25,671	25,675 (5,135) [1,232] {616}	25,679 (5,136) [1,233] {616}	25,682 (5,136) [1,233] {616}
Summit	111,846	111,860	111,873	111,887	111,911 (22,382) [5,372] {2,686}	111,933 (22,387) [5,373] {2,686}	111,955 (22,391) [5,374] {2,687}

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.