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

Date: 214/22

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 2/14/22 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.

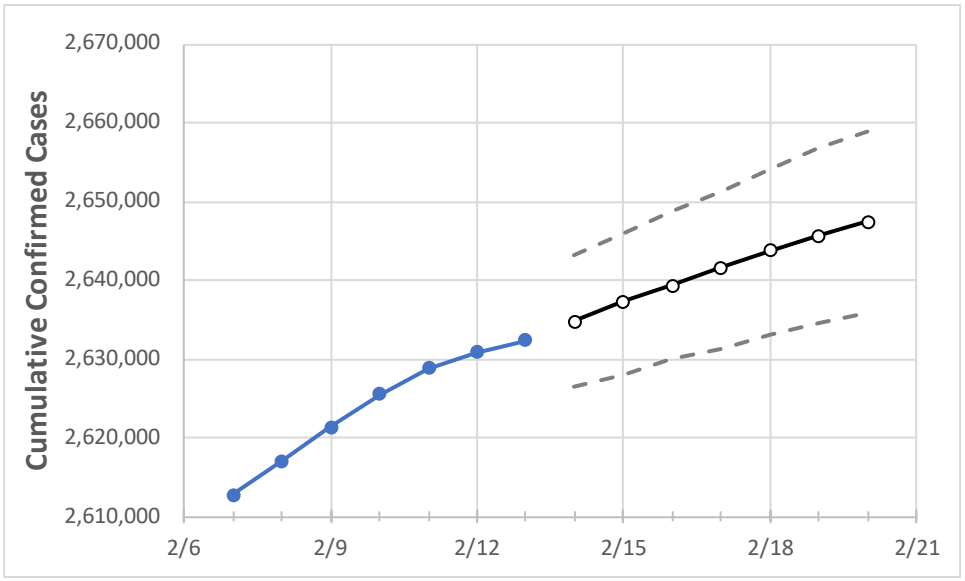
IEM's Modeling Lead

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:						
	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20
Ohio	2,625,551	2,628,814	2,630,846	2,632,336	2,634,709	2,637,252	2,639,378	2,641,548	2,643,754	2,645,611	2,647,412

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:						
	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20
Athens	13,861	13,920	14,000	14,007	14,034	14,064	14,090	14,116	14,143	14,163	14,188
Cuyahoga	264,725	264,870	264,982	265,049	265,163	265,268	265,366	265,462	265,561	265,651	265,742
Franklin	283,180	283,512	283,736	283,922	284,168	284,413	284,632	284,842	285,056	285,248	285,425
Hamilton	184,019	184,216	184,335	184,441	184,609	184,767	184,912	185,052	185,174	185,306	185,428
Lake	48,267	48,296	48,322	48,343	48,363	48,383	48,403	48,421	48,439	48,456	48,472
Lorain	65,732	65,775	65,799	65,820	65,869	65,918	65,959	66,002	66,052	66,092	66,132
Lucas	97,463	97,570	97,667	97,725	97,818	97,910	97,998	98,079	98,154	98,232	98,311
Mahoning	52,628	52,682	52,715	52,748	52,784	52,819	52,852	52,884	52,916	52,946	52,973
Medina	39,508	39,546	39,554	39,571	39,590	39,608	39,624	39,640	39,654	39,669	39,682
Miami	25,401	25,427	25,435	25,448	25,469	25,491	25,509	25,528	25,542	25,561	25,576
Summit	110,932	111,034	111,067	111,114	111,170	111,221	111,270	111,319	111,363	111,408	111,449

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:		
	2/10	2/11	2/12	2/13	2/15	2/17	2/19
Athens	13,861	13,920	14,000	14,007	14,064 (2,813) [675] {338}	14,116 (2,823) [678] {339}	14,163 (2,833) [680] {340}
Cuyahoga	264,725	264,870	264,982	265,049	265,268 (53,054) [12,733] {6,366}	265,462 (53,092) [12,742] {6,371}	265,651 (53,130) [12,751] {6,376}
Franklin	283,180	283,512	283,736	283,922	284,413 (56,883) [13,652] {6,826}	284,842 (56,968) [13,672] {6,836}	285,248 (57,050) [13,692] {6,846}
Hamilton	184,019	184,216	184,335	184,441	184,767 (36,953) [8,869] {4,434}	185,052 (37,010) [8,882] {4,441}	185,306 (37,061) [8,895] {4,447}
Lake	48,267	48,296	48,322	48,343	48,383 (9,677) [2,322] {1,161}	48,421 (9,684) [2,324] {1,162}	48,456 (9,691) [2,326] {1,163}
Lorain	65,732	65,775	65,799	65,820	65,918 (13,184) [3,164] {1,582}	66,002 (13,200) [3,168] {1,584}	66,092 (13,218) [3,172] {1,586}
Lucas	97,463	97,570	97,667	97,725	97,910 (19,582) [4,700] {2,350}	98,079 (19,616) [4,708] {2,354}	98,232 (19,646) [4,715] {2,358}
Mahoning	52,628	52,682	52,715	52,748	52,819 (10,564) [2,535] {1,268}	52,884 (10,577) [2,538] {1,269}	52,946 (10,589) [2,541] {1,271}
Medina	39,508	39,546	39,554	39,571	39,608 (7,922) [1,901] {951}	39,640 (7,928) [1,903] {951}	39,669 (7,934) [1,904] {952}
Miami	25,401	25,427	25,435	25,448	25,491 (5,098) [1,224] {612}	25,528 (5,106) [1,225] {613}	25,561 (5,112) [1,227] {613}
Summit	110,932	111,034	111,067	111,114	111,221 (22,244) [5,339] {2,669}	111,319 (22,264) [5,343] {2,672}	111,408 (22,282) [5,348] {2,674}

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.