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

Date: 2/25/21

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 2/25/21 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.

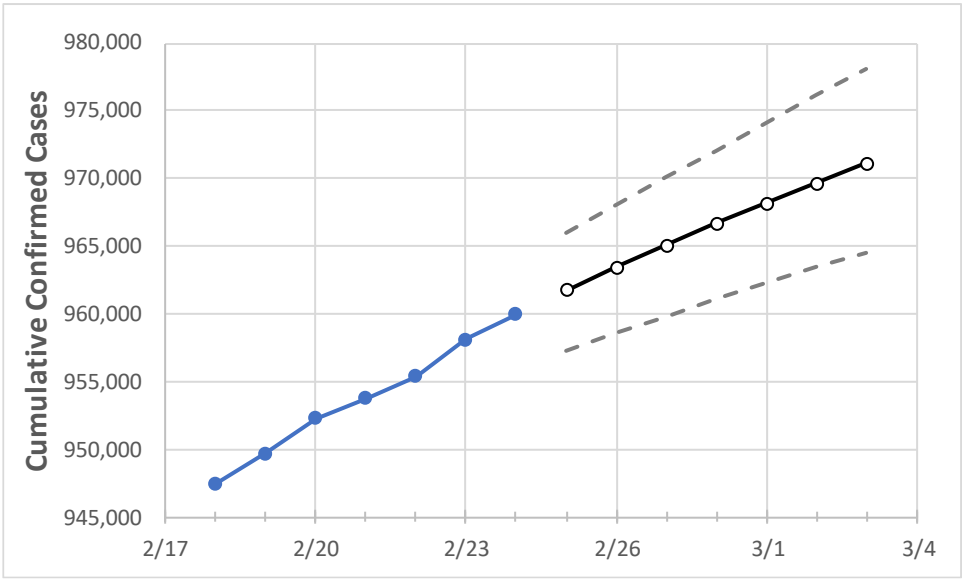
IEM's Modeling Lead

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:						
	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2	3/3
Ohio	953,767	955,378	958,153	959,995	961,754	963,470	965,084	966,667	968,185	969,675	971,126

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:						
	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2	3/3
Athens	4,536	4,550	4,562	4,573	4,589	4,604	4,619	4,634	4,648	4,663	4,677
Cuyahoga	93,959	94,021	94,420	94,594	94,749	94,903	95,054	95,199	95,341	95,472	95,601
Franklin	110,499	110,653	110,938	111,107	111,285	111,460	111,626	111,789	111,951	112,107	112,253
Hamilton	72,213	72,330	72,486	72,643	72,784	72,915	73,043	73,169	73,289	73,405	73,520
Lake	18,062	18,087	18,178	18,210	18,247	18,284	18,320	18,354	18,388	18,420	18,452
Lorain	21,602	21,667	21,738	21,781	21,830	21,877	21,923	21,968	22,012	22,054	22,094
Lucas	34,531	34,620	34,724	34,829	34,896	34,958	35,023	35,084	35,144	35,203	35,261
Mahoning	19,140	19,183	19,251	19,282	19,316	19,350	19,383	19,415	19,446	19,477	19,505
Medina	13,111	13,130	13,188	13,220	13,250	13,278	13,306	13,333	13,359	13,386	13,409
Miami	9,910	9,917	9,937	9,954	9,965	9,975	9,985	9,995	10,004	10,014	10,022
Summit	39,393	39,474	39,637	39,720	39,816	39,909	39,998	40,088	40,173	40,255	40,336

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:		
	2/21	2/22	2/23	2/24	2/26	2/28	3/2
Athens	4,536	4,550	4,562	4,573	4,604 (921) [221] {110}	4,634 (927) [222] {111}	4,663 (933) [224] {112}
Cuyahoga	93,959	94,021	94,420	94,594	94,903 (18,981) [4,555] {2,278}	95,199 (19,040) [4,570] {2,285}	95,472 (19,094) [4,583] {2,291}
Franklin	110,499	110,653	110,938	111,107	111,460 (22,292) [5,350] {2,675}	111,789 (22,358) [5,366] {2,683}	112,107 (22,421) [5,381] {2,691}
Hamilton	72,213	72,330	72,486	72,643	72,915 (14,583) [3,500] {1,750}	73,169 (14,634) [3,512] {1,756}	73,405 (14,681) [3,523] {1,762}
Lake	18,062	18,087	18,178	18,210	18,284 (3,657) [878] {439}	18,354 (3,671) [881] {440}	18,420 (3,684) [884] {442}
Lorain	21,602	21,667	21,738	21,781	21,877 (4,375) [1,050] {525}	21,968 (4,394) [1,054] {527}	22,054 (4,411) [1,059] {529}
Lucas	34,531	34,620	34,724	34,829	34,958 (6,992) [1,678] {839}	35,084 (7,017) [1,684] {842}	35,203 (7,041) [1,690] {845}
Mahoning	19,140	19,183	19,251	19,282	19,350 (3,870) [929] {464}	19,415 (3,883) [932] {466}	19,477 (3,895) [935] {467}
Medina	13,111	13,130	13,188	13,220	13,278 (2,656) [637] {319}	13,333 (2,667) [640] {320}	13,386 (2,677) [643] {321}
Miami	9,910	9,917	9,937	9,954	9,975 (1,995) [479] {239}	9,995 (1,999) [480] {240}	10,014 (2,003) [481] {240}
Summit	39,393	39,474	39,637	39,720	39,909 (7,982) [1,916] {958}	40,088 (8,018) [1,924] {962}	40,255 (8,051) [1,932] {966}

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.