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

Date: 9/27/21

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 9/27/21 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.

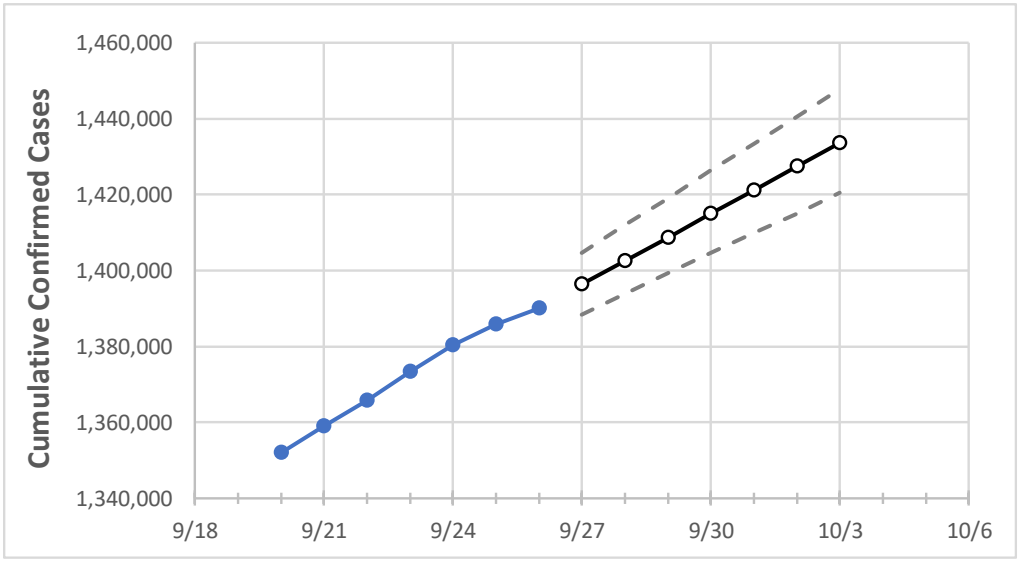
IEM's Modeling Lead

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:						
	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3
Ohio	1,373,275	1,380,370	1,385,749	1,390,015	1,396,319	1,402,622	1,408,694	1,415,005	1,421,195	1,427,491	1,433,631

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:						
	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3
Athens	7,017	7,059	7,093	7,120	7,157	7,194	7,230	7,266	7,302	7,336	7,372
Cuyahoga	134,990	135,433	135,833	136,163	136,619	137,073	137,515	137,967	138,426	138,888	139,345
Franklin	152,782	153,446	153,888	154,178	154,727	155,274	155,825	156,352	156,916	157,466	158,027
Hamilton	97,975	98,404	98,708	98,969	99,312	99,666	100,014	100,360	100,705	101,051	101,388
Lake	24,662	24,746	24,809	24,873	24,946	25,017	25,090	25,164	25,236	25,310	25,381
Lorain	31,748	31,922	32,046	32,165	32,323	32,483	32,637	32,796	32,958	33,113	33,275
Lucas	51,165	51,349	51,531	51,769	51,974	52,184	52,392	52,603	52,808	53,026	53,230
Mahoning	27,127	27,315	27,463	27,564	27,719	27,873	28,033	28,193	28,358	28,524	28,694
Medina	19,884	20,006	20,074	20,178	20,262	20,346	20,428	20,508	20,589	20,668	20,746
Miami	13,889	13,963	14,018	14,063	14,129	14,198	14,265	14,332	14,400	14,467	14,535
Summit	56,442	56,639	56,845	56,998	57,198	57,393	57,591	57,788	57,990	58,195	58,398

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:		
	9/23	9/24	9/25	9/26	9/28	9/30	10/2
Athens	7,017	7,059	7,093	7,120	7,194 (1,439) [345] {173}	7,266 (1,453) [349] {174}	7,336 (1,467) [352] {176}
Cuyahoga	134,990	135,433	135,833	136,163	137,073 (27,415) [6,579] {3,290}	137,967 (27,593) [6,622] {3,311}	138,888 (27,778) [6,667] {3,333}
Franklin	152,782	153,446	153,888	154,178	155,274 (31,055) [7,453] {3,727}	156,352 (31,270) [7,505] {3,752}	157,466 (31,493) [7,558] {3,779}
Hamilton	97,975	98,404	98,708	98,969	99,666 (19,933) [4,784] {2,392}	100,360 (20,072) [4,817] {2,409}	101,051 (20,210) [4,850] {2,425}
Lake	24,662	24,746	24,809	24,873	25,017 (5,003) [1,201] {600}	25,164 (5,033) [1,208] {604}	25,310 (5,062) [1,215] {607}
Lorain	31,748	31,922	32,046	32,165	32,483 (6,497) [1,559] {780}	32,796 (6,559) [1,574] {787}	33,113 (6,623) [1,589] {795}
Lucas	51,165	51,349	51,531	51,769	52,184 (10,437) [2,505] {1,252}	52,603 (10,521) [2,525] {1,262}	53,026 (10,605) [2,545] {1,273}
Mahoning	27,127	27,315	27,463	27,564	27,873 (5,575) [1,338] {669}	28,193 (5,639) [1,353] {677}	28,524 (5,705) [1,369] {685}
Medina	19,884	20,006	20,074	20,178	20,346 (4,069) [977] {488}	20,508 (4,102) [984] {492}	20,668 (4,134) [992] {496}
Miami	13,889	13,963	14,018	14,063	14,198 (2,840) [681] {341}	14,332 (2,866) [688] {344}	14,467 (2,893) [694] {347}
Summit	56,442	56,639	56,845	56,998	57,393 (11,479) [2,755] {1,377}	57,788 (11,558) [2,774] {1,387}	58,195 (11,639) [2,793] {1,397}

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.