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

Date: 8/27/21

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 8/27/21 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.

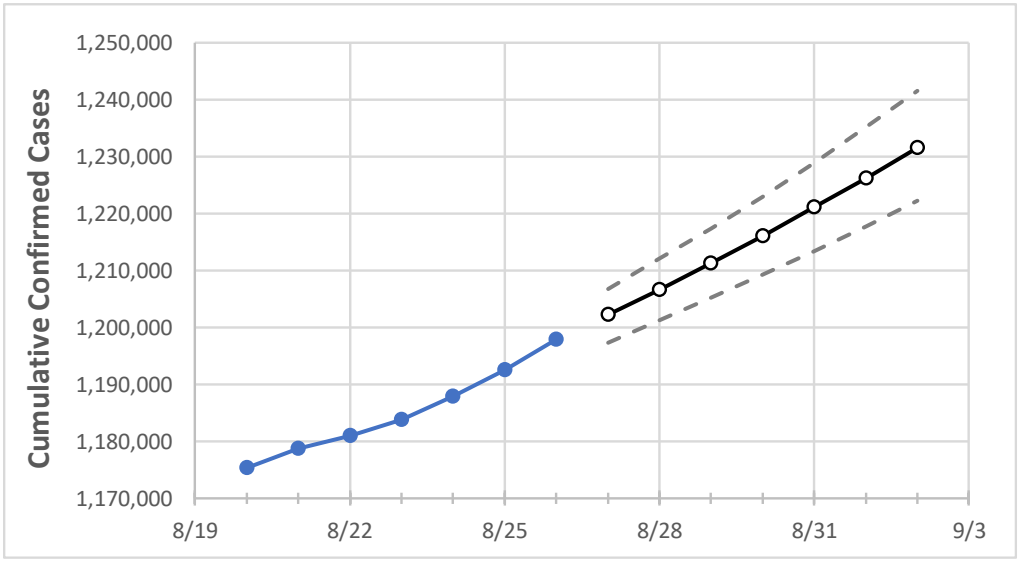
IEM's Modeling Lead

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:						
	8/23	8/24	8/25	8/26	8/27	8/28	8/29	8/30	8/31	9/1	9/2
Ohio	1,183,761	1,187,878	1,192,478	1,197,873	1,202,224	1,206,614	1,211,311	1,216,051	1,221,083	1,226,248	1,231,621

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:						
	8/23	8/24	8/25	8/26	8/27	8/28	8/29	8/30	8/31	9/1	9/2
Athens	5,483	5,515	5,547	5,591	5,627	5,666	5,710	5,756	5,808	5,864	5,926
Cuyahoga	122,111	122,407	122,770	123,148	123,493	123,854	124,225	124,613	125,013	125,433	125,853
Franklin	136,460	136,889	137,270	137,735	138,116	138,511	138,914	139,322	139,751	140,198	140,637
Hamilton	86,757	86,970	87,253	87,568	87,801	88,043	88,280	88,528	88,776	89,036	89,295
Lake	22,398	22,459	22,534	22,636	22,700	22,769	22,840	22,911	22,985	23,064	23,141
Lorain	27,403	27,479	27,579	27,698	27,788	27,882	27,977	28,078	28,179	28,286	28,395
Lucas	45,468	45,601	45,751	45,892	46,029	46,175	46,325	46,485	46,649	46,821	47,002
Mahoning	23,710	23,789	23,871	23,972	24,049	24,132	24,216	24,303	24,395	24,491	24,591
Medina	16,821	16,894	16,958	17,085	17,158	17,236	17,313	17,398	17,483	17,574	17,667
Miami	11,798	11,845	11,888	11,967	12,028	12,090	12,155	12,223	12,296	12,371	12,448
Summit	50,908	51,025	51,146	51,326	51,450	51,575	51,707	51,840	51,979	52,119	52,263

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:		
	8/23	8/24	8/25	8/26	8/28	8/30	9/1
Athens	5,483	5,515	5,547	5,591	5,666 (1,133) [272] {136}	5,756 (1,151) [276] {138}	5,864 (1,173) [281] {141}
Cuyahoga	122,111	122,407	122,770	123,148	123,854 (24,771) [5,945] {2,972}	124,613 (24,923) [5,981] {2,991}	125,433 (25,087) [6,021] {3,010}
Franklin	136,460	136,889	137,270	137,735	138,511 (27,702) [6,649] {3,324}	139,322 (27,864) [6,687] {3,344}	140,198 (28,040) [6,730] {3,365}
Hamilton	86,757	86,970	87,253	87,568	88,043 (17,609) [4,226] {2,113}	88,528 (17,706) [4,249] {2,125}	89,036 (17,807) [4,274] {2,137}
Lake	22,398	22,459	22,534	22,636	22,769 (4,554) [1,093] {546}	22,911 (4,582) [1,100] {550}	23,064 (4,613) [1,107] {554}
Lorain	27,403	27,479	27,579	27,698	27,882 (5,576) [1,338] {669}	28,078 (5,616) [1,348] {674}	28,286 (5,657) [1,358] {679}
Lucas	45,468	45,601	45,751	45,892	46,175 (9,235) [2,216] {1,108}	46,485 (9,297) [2,231] {1,116}	46,821 (9,364) [2,247] {1,124}
Mahoning	23,710	23,789	23,871	23,972	24,132 (4,826) [1,158] {579}	24,303 (4,861) [1,167] {583}	24,491 (4,898) [1,176] {588}
Medina	16,821	16,894	16,958	17,085	17,236 (3,447) [827] {414}	17,398 (3,480) [835] {418}	17,574 (3,515) [844] {422}
Miami	11,798	11,845	11,888	11,967	12,090 (2,418) [580] {290}	12,223 (2,445) [587] {293}	12,371 (2,474) [594] {297}
Summit	50,908	51,025	51,146	51,326	51,575 (10,315) [2,476] {1,238}	51,840 (10,368) [2,488] {1,244}	52,119 (10,424) [2,502] {1,251}

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.