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

Date: 9/1/21

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 9/1/21 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.

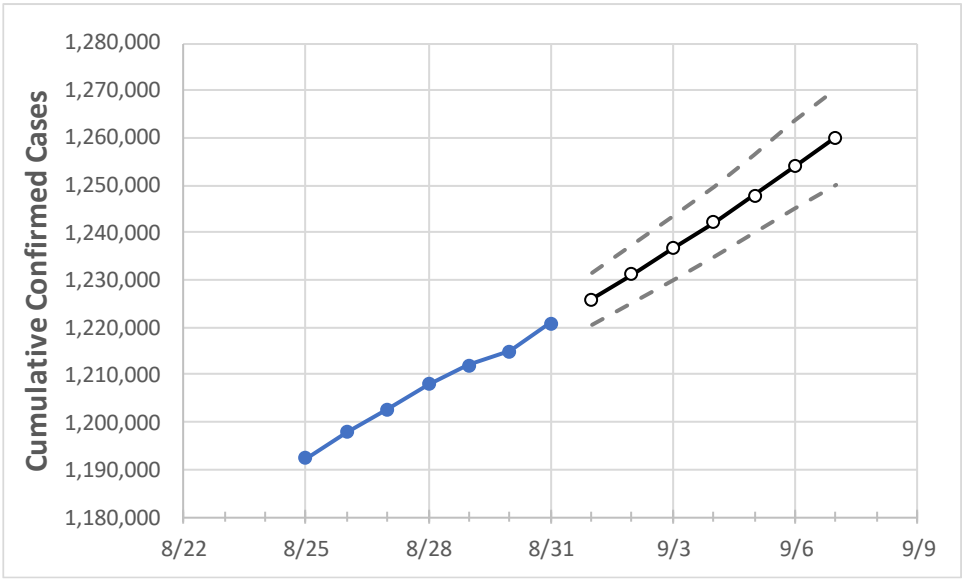
IEM's Modeling Lead

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:						
	8/28	8/29	8/30	8/31	9/1	9/2	9/3	9/4	9/5	9/6	9/7
Ohio	1,207,932	1,211,895	1,214,986	1,220,900	1,225,938	1,231,232	1,236,679	1,242,172	1,247,930	1,253,951	1,260,135

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:						
	8/28	8/29	8/30	8/31	9/1	9/2	9/3	9/4	9/5	9/6	9/7
Athens	5,692	5,729	5,753	5,823	5,880	5,940	6,007	6,076	6,152	6,236	6,322
Cuyahoga	123,867	124,150	124,453	124,761	125,120	125,488	125,859	126,246	126,648	127,054	127,476
Franklin	138,592	138,918	139,178	139,758	140,201	140,649	141,104	141,573	142,053	142,554	143,056
Hamilton	88,098	88,367	88,497	88,832	89,093	89,357	89,629	89,899	90,179	90,467	90,754
Lake	22,792	22,841	22,882	22,943	23,014	23,085	23,158	23,234	23,311	23,393	23,473
Lorain	27,908	28,005	28,095	28,177	28,280	28,385	28,494	28,606	28,720	28,841	28,962
Lucas	46,173	46,275	46,353	46,487	46,632	46,781	46,933	47,090	47,254	47,423	47,598
Mahoning	24,119	24,175	24,237	24,342	24,428	24,518	24,612	24,706	24,806	24,910	25,016
Medina	17,292	17,379	17,451	17,535	17,630	17,731	17,836	17,944	18,055	18,173	18,294
Miami	12,080	12,137	12,166	12,234	12,300	12,368	12,436	12,509	12,583	12,660	12,738
Summit	51,666	51,791	51,930	52,099	52,258	52,421	52,590	52,764	52,944	53,129	53,322

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:		
	8/28	8/29	8/30	8/31	9/2	9/4	9/6
Athens	5,692	5,729	5,753	5,823	5,940 (1,188) [285] {143}	6,076 (1,215) [292] {146}	6,236 (1,247) [299] {150}
Cuyahoga	123,867	124,150	124,453	124,761	125,488 (25,098) [6,023] {3,012}	126,246 (25,249) [6,060] {3,030}	127,054 (25,411) [6,099] {3,049}
Franklin	138,592	138,918	139,178	139,758	140,649 (28,130) [6,751] {3,376}	141,573 (28,315) [6,795] {3,398}	142,554 (28,511) [6,843] {3,421}
Hamilton	88,098	88,367	88,497	88,832	89,357 (17,871) [4,289] {2,145}	89,899 (17,980) [4,315] {2,158}	90,467 (18,093) [4,342] {2,171}
Lake	22,792	22,841	22,882	22,943	23,085 (4,617) [1,108] {554}	23,234 (4,647) [1,115] {558}	23,393 (4,679) [1,123] {561}
Lorain	27,908	28,005	28,095	28,177	28,385 (5,677) [1,362] {681}	28,606 (5,721) [1,373] {687}	28,841 (5,768) [1,384] {692}
Lucas	46,173	46,275	46,353	46,487	46,781 (9,356) [2,245] {1,123}	47,090 (9,418) [2,260] {1,130}	47,423 (9,485) [2,276] {1,138}
Mahoning	24,119	24,175	24,237	24,342	24,518 (4,904) [1,177] {588}	24,706 (4,941) [1,186] {593}	24,910 (4,982) [1,196] {598}
Medina	17,292	17,379	17,451	17,535	17,731 (3,546) [851] {426}	17,944 (3,589) [861] {431}	18,173 (3,635) [872] {436}
Miami	12,080	12,137	12,166	12,234	12,368 (2,474) [594] {297}	12,509 (2,502) [600] {300}	12,660 (2,532) [608] {304}
Summit	51,666	51,791	51,930	52,099	52,421 (10,484) [2,516] {1,258}	52,764 (10,553) [2,533] {1,266}	53,129 (10,626) [2,550] {1,275}

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.