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

Date: 1/10/22

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 1/10/22 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.

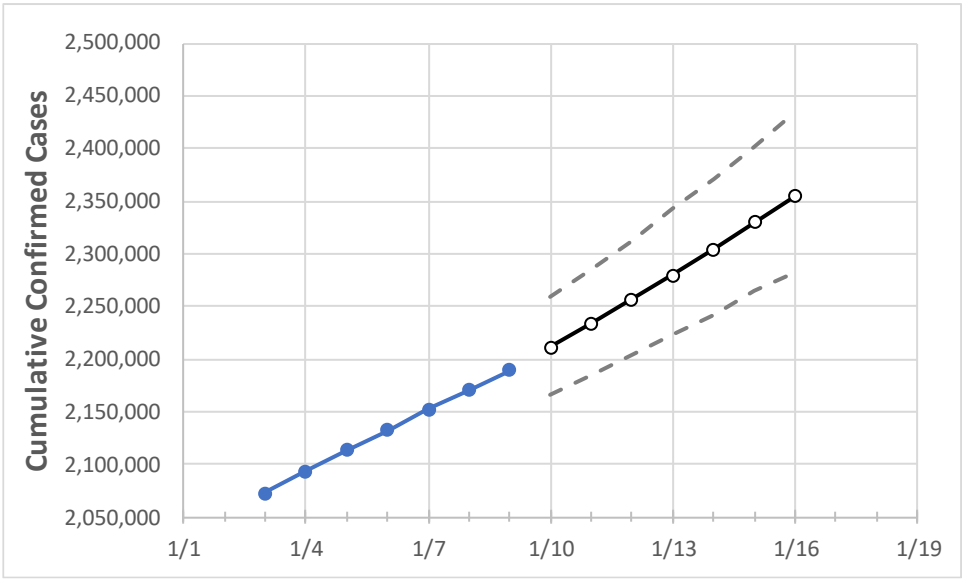
IEM's Modeling Lead

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:						
	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16
Ohio	2,132,266	2,151,829	2,170,139	2,189,228	2,211,150	2,233,725	2,256,634	2,279,756	2,304,486	2,329,740	2,354,870

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:						
	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16
Athens	9,476	9,573	9,668	9,727	9,813	9,905	9,999	10,100	10,205	10,315	10,429
Cuyahoga	241,253	242,580	244,036	245,761	247,966	250,121	252,130	254,191	256,246	258,362	260,379
Franklin	224,356	227,382	229,808	232,385	235,865	239,466	243,241	247,095	251,280	255,550	260,078
Hamilton	141,626	143,634	145,454	147,629	149,884	152,227	154,645	157,196	159,916	162,702	165,636
Lake	43,655	43,904	44,184	44,577	45,043	45,514	45,980	46,463	46,952	47,452	47,930
Lorain	57,527	57,873	58,486	58,955	59,680	60,448	61,171	61,925	62,722	63,526	64,333
Lucas	76,673	77,324	78,278	79,187	80,200	81,235	82,311	83,447	84,627	85,862	87,148
Mahoning	44,148	44,559	44,957	45,385	45,930	46,507	47,091	47,696	48,339	49,001	49,680
Medina	34,038	34,374	34,717	35,210	35,638	36,060	36,495	36,943	37,405	37,874	38,353
Miami	20,155	20,347	20,486	20,601	20,757	20,918	21,084	21,254	21,429	21,613	21,799
Summit	97,378	98,168	98,890	99,952	101,186	102,438	103,688	104,982	106,275	107,635	109,014

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:											
	1/6	1/7	1/8	1/9	1/11				1/13				1/15			
Athens	9,476	9,573	9,668	9,727	9,905	(1,981)	[475]	{238}	10,100	(2,020)	[485]	{242}	10,315	(2,063)	[495]	{248}
Cuyahoga	241,253	242,580	244,036	245,761	250,121	(50,024)	[12,006]	{6,003}	254,191	(50,838)	[12,201]	{6,101}	258,362	(51,672)	[12,401]	{6,201}
Franklin	224,356	227,382	229,808	232,385	239,466	(47,893)	[11,494]	{5,747}	247,095	(49,419)	[11,861]	{5,930}	255,550	(51,110)	[12,266]	{6,133}
Hamilton	141,626	143,634	145,454	147,629	152,227	(30,445)	[7,307]	{3,653}	157,196	(31,439)	[7,545]	{3,773}	162,702	(32,540)	[7,810]	{3,905}
Lake	43,655	43,904	44,184	44,577	45,514	(9,103)	[2,185]	{1,092}	46,463	(9,293)	[2,230]	{1,115}	47,452	(9,490)	[2,278]	{1,139}
Lorain	57,527	57,873	58,486	58,955	60,448	(12,090)	[2,901]	{1,451}	61,925	(12,385)	[2,972]	{1,486}	63,526	(12,705)	[3,049]	{1,525}
Lucas	76,673	77,324	78,278	79,187	81,235	(16,247)	[3,899]	{1,950}	83,447	(16,689)	[4,005]	{2,003}	85,862	(17,172)	[4,121]	{2,061}
Mahoning	44,148	44,559	44,957	45,385	46,507	(9,301)	[2,232]	{1,116}	47,696	(9,539)	[2,289]	{1,145}	49,001	(9,800)	[2,352]	{1,176}
Medina	34,038	34,374	34,717	35,210	36,060	(7,212)	[1,731]	{865}	36,943	(7,389)	[1,773]	{887}	37,874	(7,575)	[1,818]	{909}
Miami	20,155	20,347	20,486	20,601	20,918	(4,184)	[1,004]	{502}	21,254	(4,251)	[1,020]	{510}	21,613	(4,323)	[1,037]	{519}
Summit	97,378	98,168	98,890	99,952	102,438	(20,488)	[4,917]	{2,459}	104,982	(20,996)	[5,039]	{2,520}	107,635	(21,527)	[5,166]	{2,583}

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.