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

Date: 9/20/21

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 9/20/21 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.

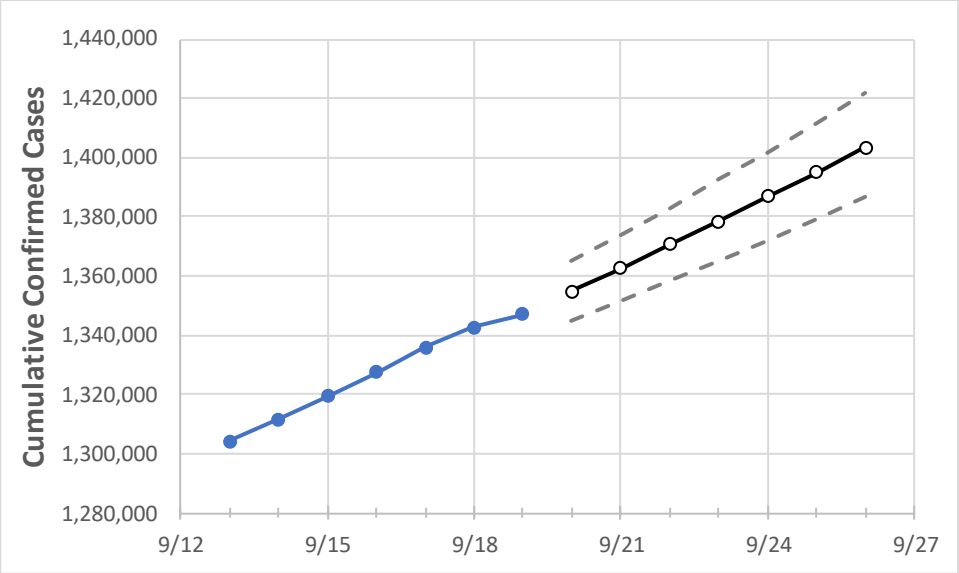
IEM's Modeling Lead

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:						
	9/16	9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26
Ohio	1,327,614	1,336,061	1,342,777	1,347,205	1,354,826	1,362,663	1,370,599	1,378,538	1,386,755	1,395,084	1,403,583

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:						
	9/16	9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26
Athens	6,690	6,755	6,810	6,855	6,906	6,959	7,011	7,063	7,117	7,171	7,224
Cuyahoga	131,694	132,283	132,773	133,138	133,653	134,172	134,703	135,247	135,795	136,348	136,929
Franklin	148,873	149,655	150,219	150,587	151,254	151,917	152,586	153,276	153,965	154,688	155,403
Hamilton	95,329	95,838	96,279	96,550	96,975	97,408	97,830	98,263	98,718	99,168	99,614
Lake	24,170	24,249	24,339	24,390	24,473	24,558	24,644	24,729	24,820	24,908	25,001
Lorain	30,651	30,874	31,004	31,113	31,320	31,519	31,729	31,943	32,165	32,395	32,631
Lucas	49,821	50,067	50,248	50,396	50,650	50,908	51,168	51,435	51,706	51,992	52,271
Mahoning	26,145	26,312	26,462	26,558	26,715	26,878	27,043	27,209	27,382	27,564	27,747
Medina	19,320	19,424	19,478	19,532	19,649	19,768	19,885	20,005	20,126	20,248	20,377
Miami	13,369	13,473	13,549	13,594	13,679	13,762	13,844	13,930	14,018	14,108	14,197
Summit	55,073	55,309	55,514	55,657	55,878	56,095	56,318	56,539	56,771	57,007	57,239

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:											
	9/16	9/17	9/18	9/19	9/21				9/23				9/25			
Athens	6,690	6,755	6,810	6,855	6,959	(1,392)	[334]	{167}	7,063	(1,413)	[339]	{170}	7,171	(1,434)	[344]	{172}
Cuyahoga	131,694	132,283	132,773	133,138	134,172	(26,834)	[6,440]	{3,220}	135,247	(27,049)	[6,492]	{3,246}	136,348	(27,270)	[6,545]	{3,272}
Franklin	148,873	149,655	150,219	150,587	151,917	(30,383)	[7,292]	{3,646}	153,276	(30,655)	[7,357]	{3,679}	154,688	(30,938)	[7,425]	{3,713}
Hamilton	95,329	95,838	96,279	96,550	97,408	(19,482)	[4,676]	{2,338}	98,263	(19,653)	[4,717]	{2,358}	99,168	(19,834)	[4,760]	{2,380}
Lake	24,170	24,249	24,339	24,390	24,558	(4,912)	[1,179]	{589}	24,729	(4,946)	[1,187]	{594}	24,908	(4,982)	[1,196]	{598}
Lorain	30,651	30,874	31,004	31,113	31,519	(6,304)	[1,513]	{756}	31,943	(6,389)	[1,533]	{767}	32,395	(6,479)	[1,555]	{777}
Lucas	49,821	50,067	50,248	50,396	50,908	(10,182)	[2,444]	{1,222}	51,435	(10,287)	[2,469]	{1,234}	51,992	(10,398)	[2,496]	{1,248}
Mahoning	26,145	26,312	26,462	26,558	26,878	(5,376)	[1,290]	{645}	27,209	(5,442)	[1,306]	{653}	27,564	(5,513)	[1,323]	{662}
Medina	19,320	19,424	19,478	19,532	19,768	(3,954)	[949]	{474}	20,005	(4,001)	[960]	{480}	20,248	(4,050)	[972]	{486}
Miami	13,369	13,473	13,549	13,594	13,762	(2,752)	[661]	{330}	13,930	(2,786)	[669]	{334}	14,108	(2,822)	[677]	{339}
Summit	55,073	55,309	55,514	55,657	56,095	(11,219)	[2,693]	{1,346}	56,539	(11,308)	[2,714]	{1,357}	57,007	(11,401)	[2,736]	{1,368}

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.