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

Date: 10/29/21

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 10/29/21 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.

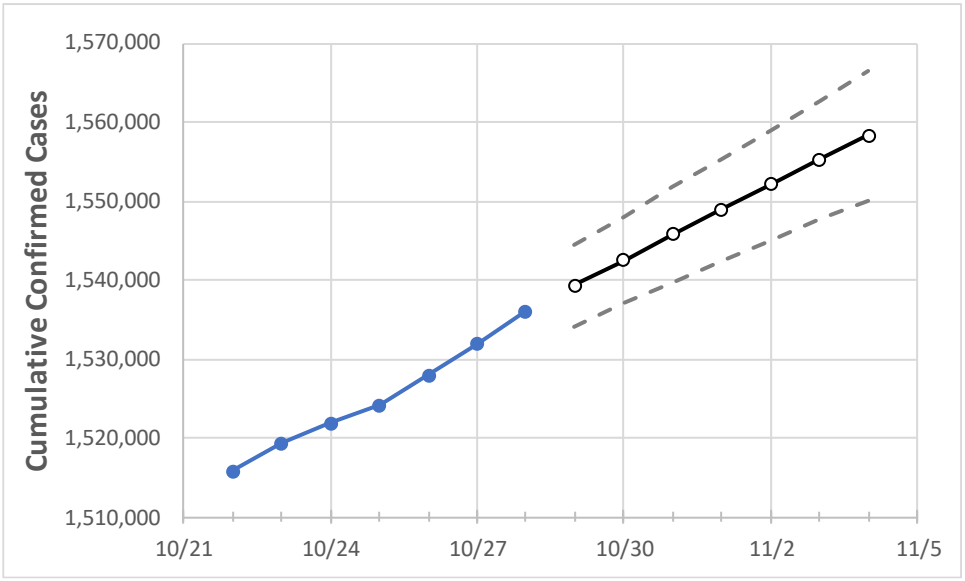
IEM's Modeling Lead

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:						
	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1	11/2	11/3	11/4
Ohio	1,524,169	1,527,976	1,531,815	1,536,005	1,539,303	1,542,556	1,545,779	1,548,981	1,552,144	1,555,293	1,558,333

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:						
	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1	11/2	11/3	11/4
Athens	7,795	7,807	7,836	7,855	7,869	7,883	7,897	7,910	7,924	7,936	7,950
Cuyahoga	146,893	147,178	147,492	147,822	148,109	148,389	148,672	148,949	149,224	149,495	149,766
Franklin	164,659	164,969	165,272	165,652	165,919	166,188	166,442	166,704	166,965	167,223	167,471
Hamilton	105,605	105,744	105,888	106,083	106,225	106,368	106,502	106,637	106,774	106,903	107,032
Lake	27,179	27,256	27,328	27,420	27,494	27,567	27,639	27,713	27,786	27,858	27,929
Lorain	35,783	35,859	36,003	36,118	36,209	36,301	36,389	36,479	36,568	36,657	36,741
Lucas	56,539	56,681	56,817	56,913	57,026	57,138	57,250	57,359	57,466	57,576	57,680
Mahoning	30,927	30,996	31,063	31,178	31,258	31,336	31,413	31,488	31,562	31,638	31,710
Medina	22,149	22,201	22,262	22,344	22,399	22,454	22,508	22,561	22,617	22,671	22,723
Miami	15,627	15,676	15,717	15,779	15,817	15,853	15,889	15,925	15,960	15,996	16,030
Summit	62,022	62,185	62,336	62,508	62,647	62,785	62,921	63,056	63,193	63,330	63,460

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:											
	10/25	10/26	10/27	10/28	10/30				11/1				11/3			
Athens	7,795	7,807	7,836	7,855	7,883	(1,577)	[378]	{189}	7,910	(1,582)	[380]	{190}	7,936	(1,587)	[381]	{190}
Cuyahoga	146,893	147,178	147,492	147,822	148,389	(29,678)	[7,123]	{3,561}	148,949	(29,790)	[7,150]	{3,575}	149,495	(29,899)	[7,176]	{3,588}
Franklin	164,659	164,969	165,272	165,652	166,188	(33,238)	[7,977]	{3,989}	166,704	(33,341)	[8,002]	{4,001}	167,223	(33,445)	[8,027]	{4,013}
Hamilton	105,605	105,744	105,888	106,083	106,368	(21,274)	[5,106]	{2,553}	106,637	(21,327)	[5,119]	{2,559}	106,903	(21,381)	[5,131]	{2,566}
Lake	27,179	27,256	27,328	27,420	27,567	(5,513)	[1,323]	{662}	27,713	(5,543)	[1,330]	{665}	27,858	(5,572)	[1,337]	{669}
Lorain	35,783	35,859	36,003	36,118	36,301	(7,260)	[1,742]	{871}	36,479	(7,296)	[1,751]	{876}	36,657	(7,331)	[1,760]	{880}
Lucas	56,539	56,681	56,817	56,913	57,138	(11,428)	[2,743]	{1,371}	57,359	(11,472)	[2,753]	{1,377}	57,576	(11,515)	[2,764]	{1,382}
Mahoning	30,927	30,996	31,063	31,178	31,336	(6,267)	[1,504]	{752}	31,488	(6,298)	[1,511]	{756}	31,638	(6,328)	[1,519]	{759}
Medina	22,149	22,201	22,262	22,344	22,454	(4,491)	[1,078]	{539}	22,561	(4,512)	[1,083]	{541}	22,671	(4,534)	[1,088]	{544}
Miami	15,627	15,676	15,717	15,779	15,853	(3,171)	[761]	{380}	15,925	(3,185)	[764]	{382}	15,996	(3,199)	[768]	{384}
Summit	62,022	62,185	62,336	62,508	62,785	(12,557)	[3,014]	{1,507}	63,056	(12,611)	[3,027]	{1,513}	63,330	(12,666)	[3,040]	{1,520}

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.