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

Date: 10/20/21

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 10/20/21 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.

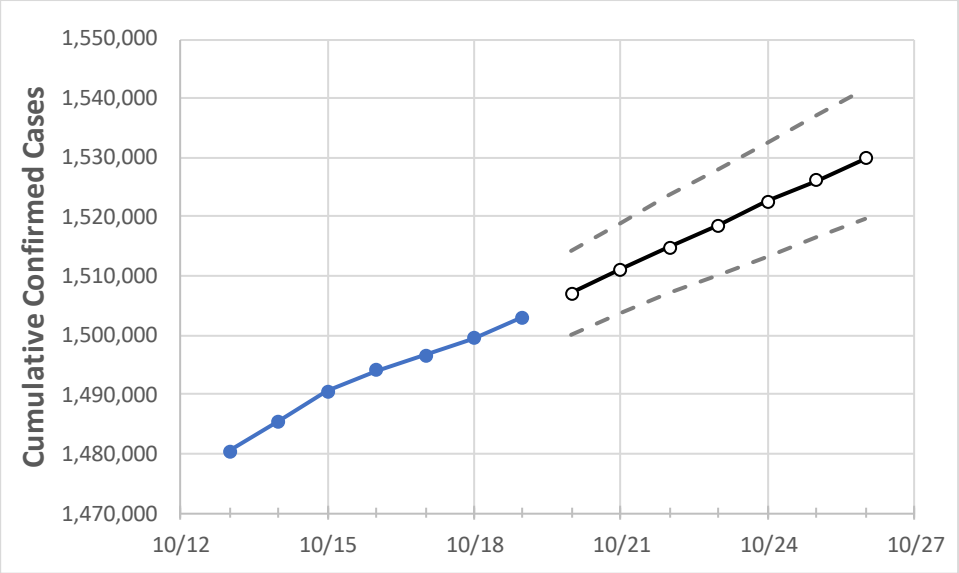
IEM's Modeling Lead

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:						
	10/16	10/17	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26
Ohio	1,494,160	1,496,675	1,499,485	1,503,102	1,507,072	1,511,046	1,514,797	1,518,622	1,522,546	1,526,210	1,529,920

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:						
	10/16	10/17	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26
Athens	7,670	7,680	7,695	7,704	7,722	7,739	7,756	7,773	7,789	7,805	7,820
Cuyahoga	144,251	144,542	144,766	145,040	145,385	145,730	146,064	146,408	146,756	147,092	147,427
Franklin	162,302	162,448	162,629	162,900	163,202	163,488	163,786	164,072	164,345	164,630	164,904
Hamilton	104,229	104,360	104,476	104,626	104,808	104,983	105,148	105,323	105,486	105,655	105,813
Lake	26,543	26,609	26,669	26,743	26,829	26,915	27,001	27,089	27,176	27,265	27,353
Lorain	34,972	35,055	35,141	35,232	35,345	35,459	35,568	35,680	35,789	35,900	36,004
Lucas	55,462	55,560	55,643	55,753	55,911	56,065	56,216	56,366	56,519	56,672	56,819
Mahoning	30,168	30,234	30,315	30,400	30,516	30,624	30,734	30,846	30,958	31,072	31,178
Medina	21,673	21,706	21,763	21,813	21,871	21,928	21,983	22,038	22,093	22,148	22,205
Miami	15,305	15,335	15,355	15,396	15,441	15,486	15,529	15,573	15,613	15,657	15,698
Summit	60,792	60,940	61,042	61,200	61,370	61,540	61,705	61,870	62,042	62,207	62,373

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:											
	10/16	10/17	10/18	10/19	10/21				10/23				10/25			
Athens	7,670	7,680	7,695	7,704	7,739	(1,548)	[371]	{186}	7,773	(1,555)	[373]	{187}	7,805	(1,561)	[375]	{187}
Cuyahoga	144,251	144,542	144,766	145,040	145,730	(29,146)	[6,995]	{3,498}	146,408	(29,282)	[7,028]	{3,514}	147,092	(29,418)	[7,060]	{3,530}
Franklin	162,302	162,448	162,629	162,900	163,488	(32,698)	[7,847]	{3,924}	164,072	(32,814)	[7,875]	{3,938}	164,630	(32,926)	[7,902]	{3,951}
Hamilton	104,229	104,360	104,476	104,626	104,983	(20,997)	[5,039]	{2,520}	105,323	(21,065)	[5,055]	{2,528}	105,655	(21,131)	[5,071]	{2,536}
Lake	26,543	26,609	26,669	26,743	26,915	(5,383)	[1,292]	{646}	27,089	(5,418)	[1,300]	{650}	27,265	(5,453)	[1,309]	{654}
Lorain	34,972	35,055	35,141	35,232	35,459	(7,092)	[1,702]	{851}	35,680	(7,136)	[1,713]	{856}	35,900	(7,180)	[1,723]	{862}
Lucas	55,462	55,560	55,643	55,753	56,065	(11,213)	[2,691]	{1,346}	56,366	(11,273)	[2,706]	{1,353}	56,672	(11,334)	[2,720]	{1,360}
Mahoning	30,168	30,234	30,315	30,400	30,624	(6,125)	[1,470]	{735}	30,846	(6,169)	[1,481]	{740}	31,072	(6,214)	[1,491]	{746}
Medina	21,673	21,706	21,763	21,813	21,928	(4,386)	[1,053]	{526}	22,038	(4,408)	[1,058]	{529}	22,148	(4,430)	[1,063]	{532}
Miami	15,305	15,335	15,355	15,396	15,486	(3,097)	[743]	{372}	15,573	(3,115)	[747]	{374}	15,657	(3,131)	[752]	{376}
Summit	60,792	60,940	61,042	61,200	61,540	(12,308)	[2,954]	{1,477}	61,870	(12,374)	[2,970]	{1,485}	62,207	(12,441)	[2,986]	{1,493}

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.