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

Date: 12/13/21

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 12/13/21 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.

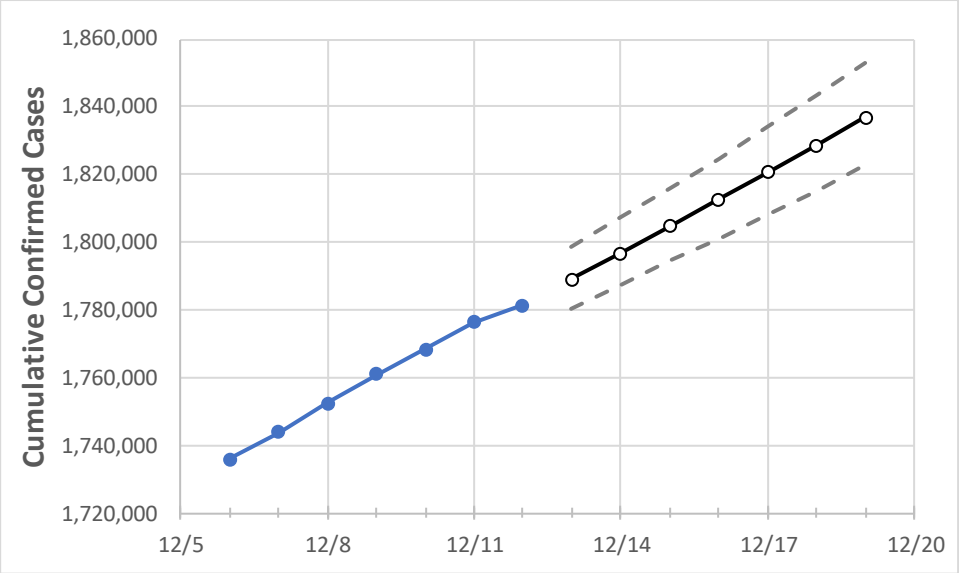
IEM's Modeling Lead

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:						
	12/9	12/10	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19
Ohio	1,761,008	1,768,367	1,776,439	1,781,411	1,789,058	1,796,748	1,804,577	1,812,630	1,820,574	1,828,722	1,836,949

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:						
	12/9	12/10	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19
Athens	8,503	8,517	8,540	8,548	8,569	8,591	8,613	8,636	8,658	8,681	8,705
Cuyahoga	173,515	174,644	175,914	176,983	178,082	179,192	180,338	181,507	182,701	183,930	185,171
Franklin	182,790	183,254	183,940	184,316	184,942	185,561	186,182	186,824	187,468	188,122	188,777
Hamilton	115,850	116,183	116,608	116,790	117,158	117,524	117,901	118,274	118,662	119,064	119,460
Lake	33,408	33,618	33,777	33,935	34,126	34,318	34,507	34,699	34,893	35,089	35,282
Lorain	43,792	44,000	44,259	44,454	44,732	45,010	45,293	45,581	45,871	46,168	46,462
Lucas	64,550	64,792	65,001	65,169	65,437	65,697	65,956	66,223	66,493	66,776	67,059
Mahoning	36,683	36,833	37,002	37,109	37,262	37,414	37,567	37,724	37,873	38,032	38,188
Medina	26,898	27,031	27,185	27,287	27,444	27,603	27,759	27,924	28,085	28,252	28,417
Miami	17,714	17,802	17,864	17,885	17,952	18,016	18,085	18,154	18,223	18,294	18,366
Summit	74,131	74,573	74,965	75,254	75,651	76,052	76,451	76,861	77,260	77,679	78,099

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:											
	12/9	12/10	12/11	12/12	12/14				12/16				12/18			
Athens	8,503	8,517	8,540	8,548	8,591	(1,718)	[412]	{206}	8,636	(1,727)	[415]	{207}	8,681	(1,736)	[417]	{208}
Cuyahoga	173,515	174,644	175,914	176,983	179,192	(35,838)	[8,601]	{4,301}	181,507	(36,301)	[8,712]	{4,356}	183,930	(36,786)	[8,829]	{4,414}
Franklin	182,790	183,254	183,940	184,316	185,561	(37,112)	[8,907]	{4,453}	186,824	(37,365)	[8,968]	{4,484}	188,122	(37,624)	[9,030]	{4,515}
Hamilton	115,850	116,183	116,608	116,790	117,524	(23,505)	[5,641]	{2,821}	118,274	(23,655)	[5,677]	{2,839}	119,064	(23,813)	[5,715]	{2,858}
Lake	33,408	33,618	33,777	33,935	34,318	(6,864)	[1,647]	{824}	34,699	(6,940)	[1,666]	{833}	35,089	(7,018)	[1,684]	{842}
Lorain	43,792	44,000	44,259	44,454	45,010	(9,002)	[2,160]	{1,080}	45,581	(9,116)	[2,188]	{1,094}	46,168	(9,234)	[2,216]	{1,108}
Lucas	64,550	64,792	65,001	65,169	65,697	(13,139)	[3,153]	{1,577}	66,223	(13,245)	[3,179]	{1,589}	66,776	(13,355)	[3,205]	{1,603}
Mahoning	36,683	36,833	37,002	37,109	37,414	(7,483)	[1,796]	{898}	37,724	(7,545)	[1,811]	{905}	38,032	(7,606)	[1,826]	{913}
Medina	26,898	27,031	27,185	27,287	27,603	(5,521)	[1,325]	{662}	27,924	(5,585)	[1,340]	{670}	28,252	(5,650)	[1,356]	{678}
Miami	17,714	17,802	17,864	17,885	18,016	(3,603)	[865]	{432}	18,154	(3,631)	[871]	{436}	18,294	(3,659)	[878]	{439}
Summit	74,131	74,573	74,965	75,254	76,052	(15,210)	[3,651]	{1,825}	76,861	(15,372)	[3,689]	{1,845}	77,679	(15,536)	[3,729]	{1,864}

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.