

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

Date: 7/9/21

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 7/9/21 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.

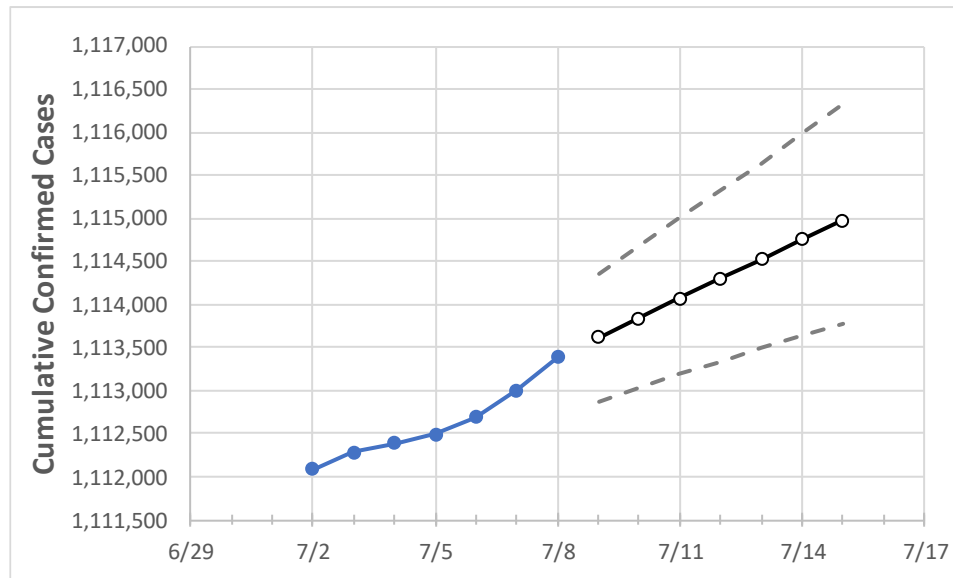
IEM's Modeling Lead

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:						
	7/5	7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13	7/14	7/15
Ohio	1,112,499	1,112,689	1,113,006	1,113,383	1,113,615	1,113,842	1,114,076	1,114,305	1,114,529	1,114,754	1,114,981

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:						
	7/5	7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13	7/14	7/15
Athens	5,250	5,251	5,250	5,249	5,250	5,251	5,252	5,253	5,253	5,254	5,255
Cuyahoga	116,147	116,156	116,189	116,238	116,257	116,276	116,294	116,312	116,330	116,348	116,365
Franklin	129,263	129,289	129,322	129,352	129,369	129,385	129,400	129,415	129,430	129,444	129,457
Hamilton	81,572	81,588	81,604	81,633	81,646	81,658	81,669	81,681	81,693	81,704	81,716
Lake	21,259	21,262	21,267	21,277	21,280	21,284	21,287	21,290	21,294	21,297	21,300
Lorain	25,735	25,739	25,751	25,754	25,757	25,761	25,764	25,767	25,770	25,773	25,775
Lucas	43,462	43,463	43,467	43,476	43,480	43,484	43,487	43,491	43,495	43,498	43,501
Mahoning	22,436	22,439	22,447	22,453	22,457	22,460	22,464	22,467	22,471	22,474	22,477
Medina	15,660	15,666	15,670	15,680	15,685	15,690	15,695	15,700	15,705	15,710	15,715
Miami	10,880	10,879	10,882	10,885	10,887	10,889	10,891	10,893	10,895	10,897	10,899
Summit	48,541	48,546	48,559	48,573	48,579	48,585	48,591	48,597	48,603	48,609	48,615

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:											
	7/5	7/6	7/7	7/8	7/10				7/12				7/14			
Athens	5,250	5,251	5,250	5,249	5,251	(1,050)	[252]	{126}	5,253	(1,051)	[252]	{126}	5,254	(1,051)	[252]	{126}
Cuyahoga	116,147	116,156	116,189	116,238	116,276	(23,255)	[5,581]	{2,791}	116,312	(23,262)	[5,583]	{2,791}	116,348	(23,270)	[5,585]	{2,792}
Franklin	129,263	129,289	129,322	129,352	129,385	(25,877)	[6,210]	{3,105}	129,415	(25,883)	[6,212]	{3,106}	129,444	(25,889)	[6,213]	{3,107}
Hamilton	81,572	81,588	81,604	81,633	81,658	(16,332)	[3,920]	{1,960}	81,681	(16,336)	[3,921]	{1,960}	81,704	(16,341)	[3,922]	{1,961}
Lake	21,259	21,262	21,267	21,277	21,284	(4,257)	[1,022]	{511}	21,290	(4,258)	[1,022]	{511}	21,297	(4,259)	[1,022]	{511}
Lorain	25,735	25,739	25,751	25,754	25,761	(5,152)	[1,237]	{618}	25,767	(5,153)	[1,237]	{618}	25,773	(5,155)	[1,237]	{619}
Lucas	43,462	43,463	43,467	43,476	43,484	(8,697)	[2,087]	{1,044}	43,491	(8,698)	[2,088]	{1,044}	43,498	(8,700)	[2,088]	{1,044}
Mahoning	22,436	22,439	22,447	22,453	22,460	(4,492)	[1,078]	{539}	22,467	(4,493)	[1,078]	{539}	22,474	(4,495)	[1,079]	{539}
Medina	15,660	15,666	15,670	15,680	15,690	(3,138)	[753]	{377}	15,700	(3,140)	[754]	{377}	15,710	(3,142)	[754]	{377}
Miami	10,880	10,879	10,882	10,885	10,889	(2,178)	[523]	{261}	10,893	(2,179)	[523]	{261}	10,897	(2,179)	[523]	{262}
Summit	48,541	48,546	48,559	48,573	48,585	(9,717)	[2,332]	{1,166}	48,597	(9,719)	[2,333]	{1,166}	48,609	(9,722)	[2,333]	{1,167}

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.