

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

Date: 7/12/21

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 7/12/21 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.

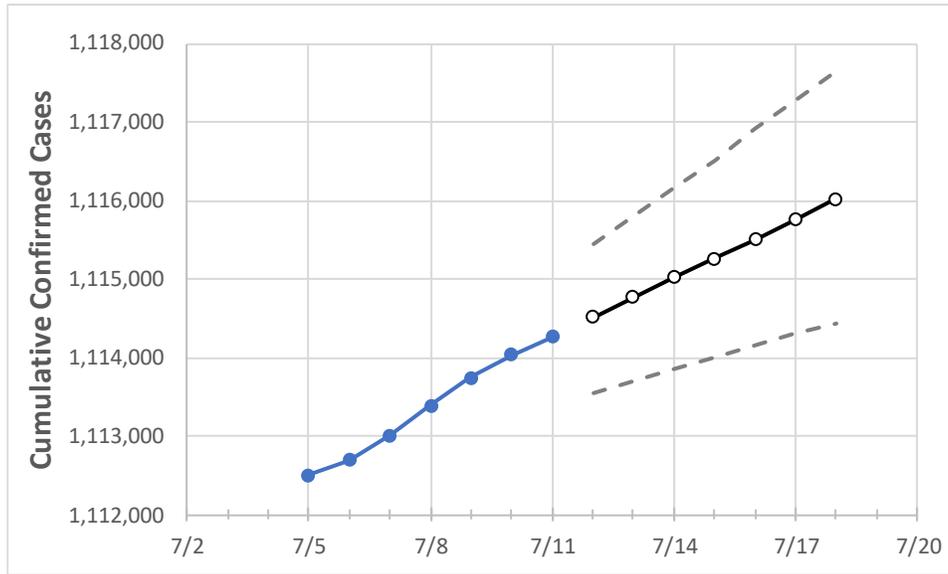
IEM's Modeling Lead

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:							
	7/8	7/9	7/10	7/11	7/12	7/13	7/14	7/15	7/16	7/17	7/18	
Ohio	1,113,383	1,113,737	1,114,036	1,114,267	1,114,516	1,114,765	1,115,019	1,115,261	1,115,506	1,115,760	1,116,016	

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:							
	7/8	7/9	7/10	7/11	7/12	7/13	7/14	7/15	7/16	7/17	7/18	
Athens	5,249	5,250	5,250	5,251	5,252	5,253	5,254	5,254	5,255	5,256	5,257	
Cuyahoga	116,238	116,268	116,294	116,308	116,328	116,347	116,366	116,385	116,404	116,422	116,440	
Franklin	129,352	129,383	129,420	129,439	129,460	129,480	129,499	129,518	129,536	129,554	129,571	
Hamilton	81,633	81,694	81,709	81,730	81,749	81,769	81,789	81,810	81,830	81,852	81,872	
Lake	21,277	21,286	21,292	21,300	21,305	21,310	21,316	21,321	21,327	21,333	21,339	
Lorain	25,754	25,760	25,763	25,768	25,771	25,775	25,778	25,782	25,785	25,788	25,791	
Lucas	43,476	43,481	43,485	43,492	43,496	43,500	43,503	43,507	43,510	43,513	43,516	
Mahoning	22,453	22,459	22,461	22,466	22,470	22,473	22,477	22,480	22,484	22,487	22,491	
Medina	15,680	15,687	15,692	15,698	15,704	15,709	15,715	15,721	15,728	15,734	15,741	
Miami	10,885	10,887	10,888	10,892	10,894	10,896	10,898	10,900	10,902	10,904	10,906	
Summit	48,573	48,584	48,592	48,596	48,602	48,609	48,615	48,621	48,627	48,633	48,638	

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:											
	7/8	7/9	7/10	7/11	7/13			7/15			7/17					
Athens	5,249	5,250	5,250	5,251	5,253	(1,051)	[252]	{126}	5,254	(1,051)	[252]	{126}	5,256	(1,051)	[252]	{126}
Cuyahoga	116,238	116,268	116,294	116,308	116,347	(23,269)	[5,585]	{2,792}	116,385	(23,277)	[5,586]	{2,793}	116,422	(23,284)	[5,588]	{2,794}
Franklin	129,352	129,383	129,420	129,439	129,480	(25,896)	[6,215]	{3,108}	129,518	(25,904)	[6,217]	{3,108}	129,554	(25,911)	[6,219]	{3,109}
Hamilton	81,633	81,694	81,709	81,730	81,769	(16,354)	[3,925]	{1,962}	81,810	(16,362)	[3,927]	{1,963}	81,852	(16,370)	[3,929]	{1,964}
Lake	21,277	21,286	21,292	21,300	21,310	(4,262)	[1,023]	{511}	21,321	(4,264)	[1,023]	{512}	21,333	(4,267)	[1,024]	{512}
Lorain	25,754	25,760	25,763	25,768	25,775	(5,155)	[1,237]	{619}	25,782	(5,156)	[1,238]	{619}	25,788	(5,158)	[1,238]	{619}
Lucas	43,476	43,481	43,485	43,492	43,500	(8,700)	[2,088]	{1,044}	43,507	(8,701)	[2,088]	{1,044}	43,513	(8,703)	[2,089]	{1,044}
Mahoning	22,453	22,459	22,461	22,466	22,473	(4,495)	[1,079]	{539}	22,480	(4,496)	[1,079]	{540}	22,487	(4,497)	[1,079]	{540}
Medina	15,680	15,687	15,692	15,698	15,709	(3,142)	[754]	{377}	15,721	(3,144)	[755]	{377}	15,734	(3,147)	[755]	{378}
Miami	10,885	10,887	10,888	10,892	10,896	(2,179)	[523]	{262}	10,900	(2,180)	[523]	{262}	10,904	(2,181)	[523]	{262}
Summit	48,573	48,584	48,592	48,596	48,609	(9,722)	[2,333]	{1,167}	48,621	(9,724)	[2,334]	{1,167}	48,633	(9,727)	[2,334]	{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.