

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

Date: 2/23/21

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 2/23/21 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.

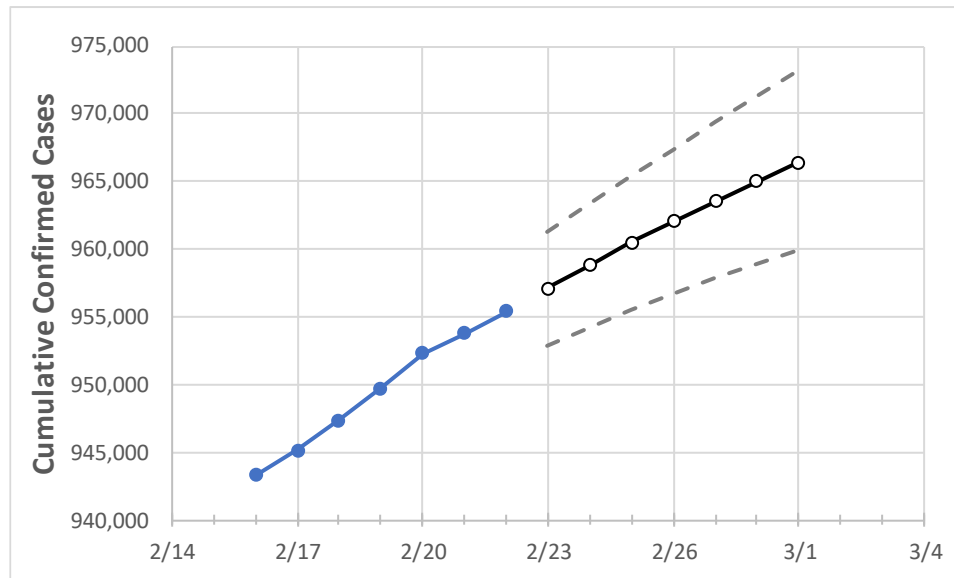
IEM's Modeling Lead

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Ohio	949,695	952,306	953,767	955,378	957,125	958,837	960,496	962,031	963,522	964,997	966,408

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Athens	4,505	4,527	4,536	4,550	4,569	4,587	4,604	4,621	4,638	4,655	4,672
Cuyahoga	93,620	93,795	93,959	94,021	94,160	94,296	94,430	94,556	94,678	94,795	94,911
Franklin	110,079	110,335	110,499	110,653	110,833	111,009	111,172	111,329	111,479	111,625	111,765
Hamilton	71,712	72,108	72,213	72,330	72,475	72,614	72,746	72,872	72,997	73,118	73,231
Lake	17,998	18,029	18,062	18,087	18,125	18,162	18,197	18,232	18,265	18,298	18,329
Lorain	21,523	21,566	21,602	21,667	21,719	21,769	21,817	21,863	21,910	21,953	21,995
Lucas	34,348	34,467	34,531	34,620	34,684	34,745	34,805	34,862	34,918	34,971	35,023
Mahoning	19,072	19,117	19,140	19,183	19,218	19,250	19,282	19,314	19,344	19,373	19,401
Medina	13,070	13,097	13,111	13,130	13,157	13,182	13,206	13,230	13,251	13,273	13,293
Miami	9,884	9,897	9,910	9,917	9,928	9,939	9,949	9,958	9,968	9,976	9,985
Summit	39,209	39,304	39,393	39,474	39,572	39,665	39,756	39,843	39,927	40,009	40,088

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:											
	2/19	2/20	2/21	2/22	2/24				2/26				2/28			
Athens	4,505	4,527	4,536	4,550	4,587	(917)	[220]	{110}	4,621	(924)	[222]	{111}	4,655	(931)	[223]	{112}
Cuyahoga	93,620	93,795	93,959	94,021	94,296	(18,859)	[4,526]	{2,263}	94,556	(18,911)	[4,539]	{2,269}	94,795	(18,959)	[4,550]	{2,275}
Franklin	110,079	110,335	110,499	110,653	111,009	(22,202)	[5,328]	{2,664}	111,329	(22,266)	[5,344]	{2,672}	111,625	(22,325)	[5,358]	{2,679}
Hamilton	71,712	72,108	72,213	72,330	72,614	(14,523)	[3,485]	{1,743}	72,872	(14,574)	[3,498]	{1,749}	73,118	(14,624)	[3,510]	{1,755}
Lake	17,998	18,029	18,062	18,087	18,162	(3,632)	[872]	{436}	18,232	(3,646)	[875]	{438}	18,298	(3,660)	[878]	{439}
Lorain	21,523	21,566	21,602	21,667	21,769	(4,354)	[1,045]	{522}	21,863	(4,373)	[1,049]	{525}	21,953	(4,391)	[1,054]	{527}
Lucas	34,348	34,467	34,531	34,620	34,745	(6,949)	[1,668]	{834}	34,862	(6,972)	[1,673]	{837}	34,971	(6,994)	[1,679]	{839}
Mahoning	19,072	19,117	19,140	19,183	19,250	(3,850)	[924]	{462}	19,314	(3,863)	[927]	{464}	19,373	(3,875)	[930]	{465}
Medina	13,070	13,097	13,111	13,130	13,182	(2,636)	[633]	{316}	13,230	(2,646)	[635]	{318}	13,273	(2,655)	[637]	{319}
Miami	9,884	9,897	9,910	9,917	9,939	(1,988)	[477]	{239}	9,958	(1,992)	[478]	{239}	9,976	(1,995)	[479]	{239}
Summit	39,209	39,304	39,393	39,474	39,665	(7,933)	[1,904]	{952}	39,843	(7,969)	[1,912]	{956}	40,009	(8,002)	[1,920]	{960}

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.