

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

Date: 1/22/21

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 1/22/21 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.**

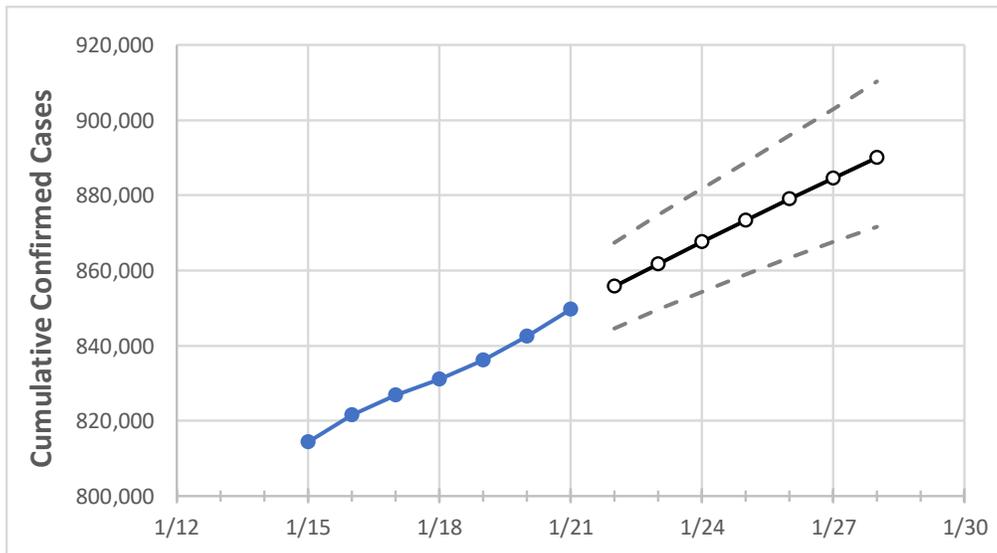
### IEM's Modeling Lead

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:						
	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28
Ohio	831,066	836,049	842,433	849,704	855,732	861,796	867,597	873,372	878,980	884,555	890,033

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:						
	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28
Athens	3,654	3,675	3,707	3,737	3,768	3,799	3,829	3,860	3,891	3,922	3,952
Cuyahoga	82,613	83,180	83,770	84,523	85,151	85,769	86,386	86,994	87,614	88,206	88,809
Franklin	97,996	98,533	99,253	100,046	100,748	101,437	102,124	102,785	103,451	104,104	104,769
Hamilton	61,629	61,931	62,391	63,092	63,602	64,118	64,635	65,148	65,663	66,189	66,710
Lake	15,491	15,592	15,747	15,882	16,022	16,157	16,292	16,423	16,553	16,685	16,812
Lorain	18,217	18,418	18,599	18,767	18,940	19,111	19,280	19,450	19,615	19,782	19,947
Lucas	30,316	30,524	30,760	31,041	31,270	31,501	31,725	31,947	32,170	32,392	32,620
Mahoning	16,815	16,931	17,035	17,163	17,261	17,359	17,455	17,553	17,648	17,739	17,832
Medina	11,191	11,286	11,364	11,439	11,522	11,602	11,682	11,761	11,838	11,916	11,993
Miami	8,905	8,952	8,999	9,073	9,127	9,179	9,228	9,278	9,325	9,370	9,413
Summit	33,603	33,849	34,150	34,405	34,701	34,989	35,286	35,573	35,856	36,140	36,421

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:								
	1/18	1/19	1/20	1/21	1/23			1/25			1/27		
Athens	3,654	3,675	3,707	3,737	3,799 (760) [182] {91}			3,860 (772) [185] {93}			3,922 (784) [188] {94}		
Cuyahoga	82,613	83,180	83,770	84,523	85,769 (17,154) [4,117] {2,058}			86,994 (17,399) [4,176] {2,088}			88,206 (17,641) [4,234] {2,117}		
Franklin	97,996	98,533	99,253	100,046	101,437 (20,287) [4,869] {2,434}			102,785 (20,557) [4,934] {2,467}			104,104 (20,821) [4,997] {2,498}		
Hamilton	61,629	61,931	62,391	63,092	64,118 (12,824) [3,078] {1,539}			65,148 (13,030) [3,127] {1,564}			66,189 (13,238) [3,177] {1,589}		
Lake	15,491	15,592	15,747	15,882	16,157 (3,231) [776] {388}			16,423 (3,285) [788] {394}			16,685 (3,337) [801] {400}		
Lorain	18,217	18,418	18,599	18,767	19,111 (3,822) [917] {459}			19,450 (3,890) [934] {467}			19,782 (3,956) [950] {475}		
Lucas	30,316	30,524	30,760	31,041	31,501 (6,300) [1,512] {756}			31,947 (6,389) [1,533] {767}			32,392 (6,478) [1,555] {777}		
Mahoning	16,815	16,931	17,035	17,163	17,359 (3,472) [833] {417}			17,553 (3,511) [843] {421}			17,739 (3,548) [851] {426}		
Medina	11,191	11,286	11,364	11,439	11,602 (2,320) [557] {278}			11,761 (2,352) [565] {282}			11,916 (2,383) [572] {286}		
Miami	8,905	8,952	8,999	9,073	9,179 (1,836) [441] {220}			9,278 (1,856) [445] {223}			9,370 (1,874) [450] {225}		
Summit	33,603	33,849	34,150	34,405	34,989 (6,998) [1,679] {840}			35,573 (7,115) [1,708] {854}			36,140 (7,228) [1,735] {867}		

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at [bryan.koon@iem.com](mailto:bryan.koon@iem.com) or 850-519-7966 or Stephanie Tennyson at [stephanie.tennyson@iem.com](mailto:stephanie.tennyson@iem.com) or 202-309-4257.