

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

Date: 3/3/21

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 3/3/21 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.

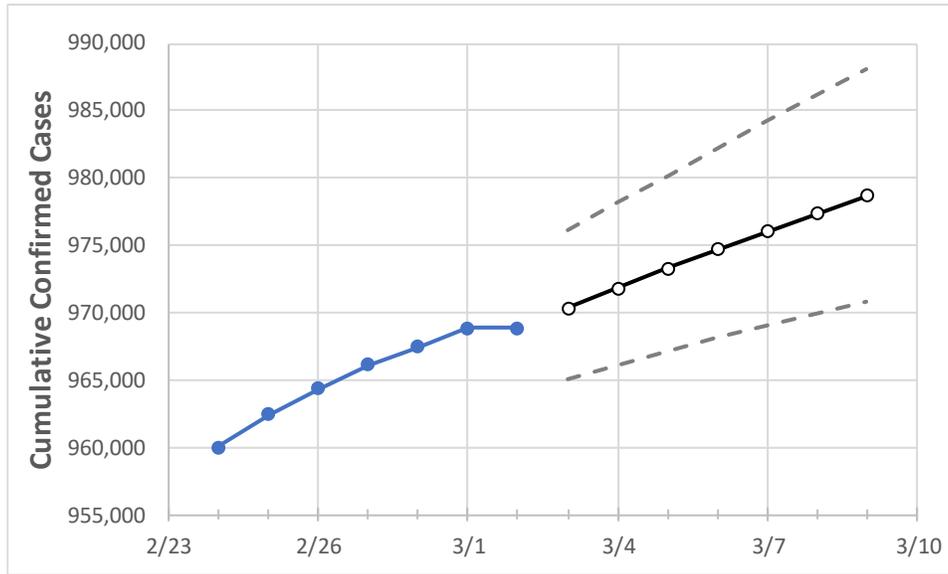
IEM's Modeling Lead

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:					
	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	
Ohio	966,154	967,422	968,874	968,874	970,367	971,836	973,265	974,666	976,040	977,369	978,681	

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:							
	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	
Athens	4,612	4,631	4,637	4,637	4,646	4,656	4,665	4,673	4,682	4,690	4,697	
Cuyahoga	95,332	95,484	95,705	95,705	95,886	96,064	96,247	96,431	96,606	96,779	96,949	
Franklin	111,688	111,851	111,987	111,987	112,142	112,293	112,437	112,583	112,723	112,861	112,999	
Hamilton	73,102	73,202	73,287	73,287	73,402	73,513	73,623	73,727	73,823	73,918	74,012	
Lake	18,335	18,358	18,379	18,379	18,409	18,437	18,465	18,491	18,519	18,544	18,567	
Lorain	21,938	21,952	21,994	21,994	22,032	22,069	22,105	22,139	22,172	22,204	22,235	
Lucas	35,149	35,217	35,279	35,279	35,364	35,449	35,533	35,616	35,699	35,784	35,867	
Mahoning	19,373	19,402	19,444	19,444	19,471	19,500	19,527	19,553	19,578	19,604	19,628	
Medina	13,327	13,347	13,370	13,370	13,394	13,418	13,440	13,462	13,484	13,504	13,525	
Miami	9,999	10,006	10,011	10,011	10,019	10,028	10,036	10,043	10,051	10,058	10,065	
Summit	40,041	40,110	40,184	40,184	40,266	40,345	40,421	40,496	40,569	40,641	40,711	

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:											
	2/27	2/28	3/1	3/2	3/4			3/6			3/8					
Athens	4,612	4,631	4,637	4,637	4,656 (931) [223] {112}			4,673 (935) [224] {112}			4,690 (938) [225] {113}					
Cuyahoga	95,332	95,484	95,705	95,705	96,064 (19,213) [4,611] {2,306}			96,431 (19,286) [4,629] {2,314}			96,779 (19,356) [4,645] {2,323}					
Franklin	111,688	111,851	111,987	111,987	112,293 (22,459) [5,390] {2,695}			112,583 (22,517) [5,404] {2,702}			112,861 (22,572) [5,417] {2,709}					
Hamilton	73,102	73,202	73,287	73,287	73,513 (14,703) [3,529] {1,764}			73,727 (14,745) [3,539] {1,769}			73,918 (14,784) [3,548] {1,774}					
Lake	18,335	18,358	18,379	18,379	18,437 (3,687) [885] {442}			18,491 (3,698) [888] {444}			18,544 (3,709) [890] {445}					
Lorain	21,938	21,952	21,994	21,994	22,069 (4,414) [1,059] {530}			22,139 (4,428) [1,063] {531}			22,204 (4,441) [1,066] {533}					
Lucas	35,149	35,217	35,279	35,279	35,449 (7,090) [1,702] {851}			35,616 (7,123) [1,710] {855}			35,784 (7,157) [1,718] {859}					
Mahoning	19,373	19,402	19,444	19,444	19,500 (3,900) [936] {468}			19,553 (3,911) [939] {469}			19,604 (3,921) [941] {470}					
Medina	13,327	13,347	13,370	13,370	13,418 (2,684) [644] {322}			13,462 (2,692) [646] {323}			13,504 (2,701) [648] {324}					
Miami	9,999	10,006	10,011	10,011	10,028 (2,006) [481] {241}			10,043 (2,009) [482] {241}			10,058 (2,012) [483] {241}					
Summit	40,041	40,110	40,184	40,184	40,345 (8,069) [1,937] {968}			40,496 (8,099) [1,944] {972}			40,641 (8,128) [1,951] {975}					

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.