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

Date: 9/13/21

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 9/13/21 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.

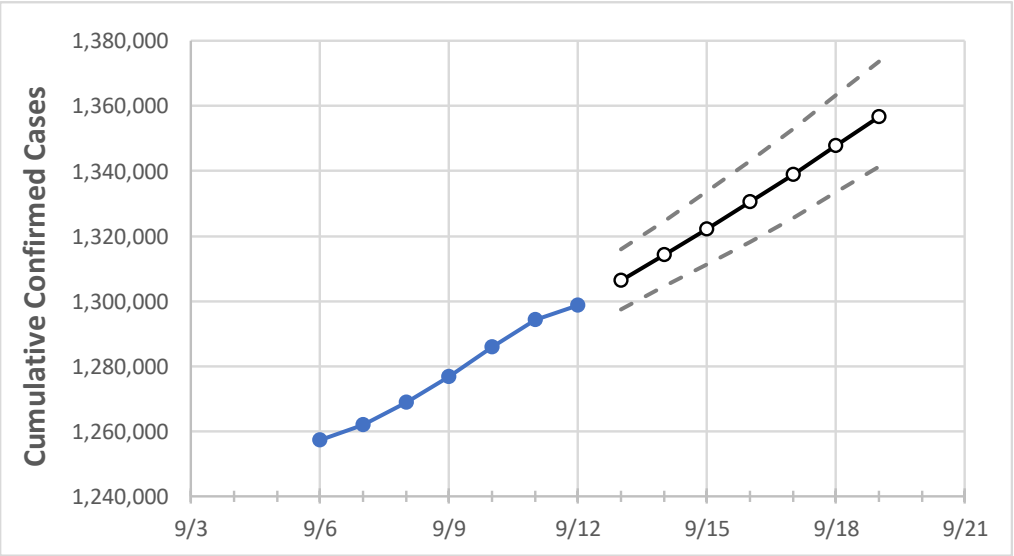
IEM's Modeling Lead

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:						
	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16	9/17	9/18	9/19
Ohio	1,276,738	1,285,757	1,294,162	1,298,625	1,306,382	1,314,281	1,322,088	1,330,454	1,338,870	1,347,641	1,356,643

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:						
	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16	9/17	9/18	9/19
Athens	6,361	6,426	6,509	6,536	6,619	6,702	6,788	6,879	6,974	7,073	7,176
Cuyahoga	128,356	128,905	129,444	129,835	130,320	130,817	131,317	131,834	132,365	132,910	133,467
Franklin	144,545	145,214	145,898	146,227	146,833	147,448	148,108	148,763	149,437	150,128	150,833
Hamilton	92,448	93,002	93,528	93,837	94,314	94,795	95,293	95,792	96,324	96,870	97,424
Lake	23,568	23,664	23,767	23,824	23,906	23,988	24,071	24,158	24,243	24,332	24,424
Lorain	29,426	29,584	29,804	29,907	30,080	30,258	30,441	30,633	30,828	31,030	31,238
Lucas	48,149	48,432	48,690	48,868	49,097	49,334	49,572	49,824	50,078	50,343	50,617
Mahoning	25,194	25,344	25,486	25,569	25,693	25,819	25,948	26,082	26,222	26,364	26,510
Medina	18,549	18,686	18,805	18,902	19,039	19,179	19,323	19,471	19,625	19,782	19,942
Miami	12,814	12,930	13,029	13,091	13,174	13,257	13,344	13,434	13,521	13,615	13,709
Summit	53,671	53,899	54,140	54,281	54,499	54,716	54,946	55,176	55,413	55,659	55,914

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:		
	9/9	9/10	9/11	9/12	9/14	9/16	9/18
Athens	6,361	6,426	6,509	6,536	6,702 (1,340) [322] {161}	6,879 (1,376) [330] {165}	7,073 (1,415) [340] {170}
Cuyahoga	128,356	128,905	129,444	129,835	130,817 (26,163) [6,279] {3,140}	131,834 (26,367) [6,328] {3,164}	132,910 (26,582) [6,380] {3,190}
Franklin	144,545	145,214	145,898	146,227	147,448 (29,490) [7,078] {3,539}	148,763 (29,753) [7,141] {3,570}	150,128 (30,026) [7,206] {3,603}
Hamilton	92,448	93,002	93,528	93,837	94,795 (18,959) [4,550] {2,275}	95,792 (19,158) [4,598] {2,299}	96,870 (19,374) [4,650] {2,325}
Lake	23,568	23,664	23,767	23,824	23,988 (4,798) [1,151] {576}	24,158 (4,832) [1,160] {580}	24,332 (4,866) [1,168] {584}
Lorain	29,426	29,584	29,804	29,907	30,258 (6,052) [1,452] {726}	30,633 (6,127) [1,470] {735}	31,030 (6,206) [1,489] {745}
Lucas	48,149	48,432	48,690	48,868	49,334 (9,867) [2,368] {1,184}	49,824 (9,965) [2,392] {1,196}	50,343 (10,069) [2,416] {1,208}
Mahoning	25,194	25,344	25,486	25,569	25,819 (5,164) [1,239] {620}	26,082 (5,216) [1,252] {626}	26,364 (5,273) [1,265] {633}
Medina	18,549	18,686	18,805	18,902	19,179 (3,836) [921] {460}	19,471 (3,894) [935] {467}	19,782 (3,956) [950] {475}
Miami	12,814	12,930	13,029	13,091	13,257 (2,651) [636] {318}	13,434 (2,687) [645] {322}	13,615 (2,723) [654] {327}
Summit	53,671	53,899	54,140	54,281	54,716 (10,943) [2,626] {1,313}	55,176 (11,035) [2,648] {1,324}	55,659 (11,132) [2,672] {1,336}

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.