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

Date: 8/2/21

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 8/2/21 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.

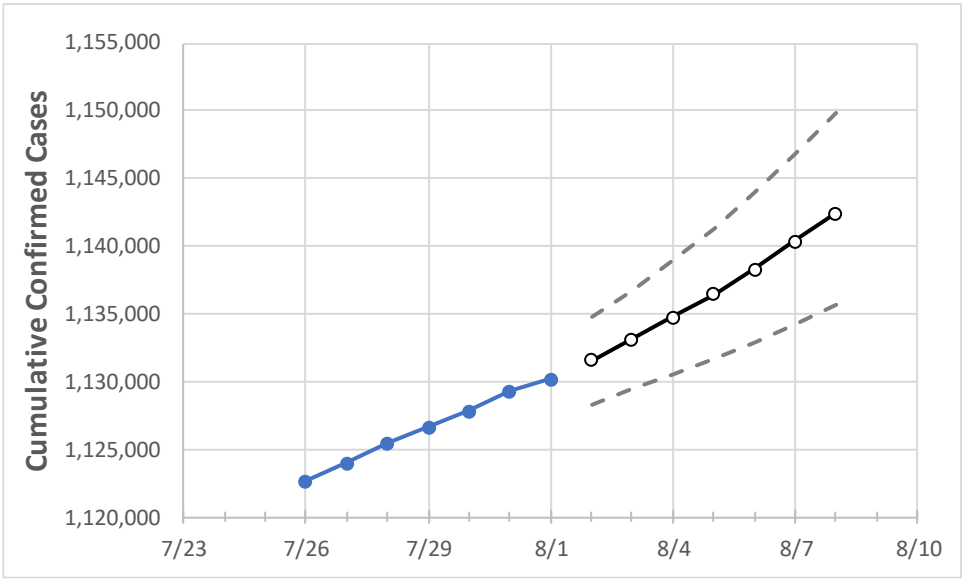
IEM's Modeling Lead

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:						
	7/29	7/30	7/31	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8
Ohio	1,126,625	1,127,808	1,129,277	1,130,134	1,131,586	1,133,097	1,134,733	1,136,478	1,138,325	1,140,331	1,142,424

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:						
	7/29	7/30	7/31	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8
Athens	5,276	5,278	5,280	5,283	5,286	5,288	5,291	5,294	5,297	5,301	5,304
Cuyahoga	117,484	117,600	117,713	117,801	117,921	118,050	118,189	118,335	118,497	118,664	118,842
Franklin	130,709	130,816	130,973	131,036	131,185	131,340	131,509	131,689	131,883	132,093	132,314
Hamilton	82,619	82,697	82,804	82,870	82,973	83,083	83,202	83,328	83,463	83,606	83,757
Lake	21,509	21,524	21,538	21,548	21,565	21,582	21,599	21,618	21,637	21,657	21,678
Lorain	26,104	26,135	26,166	26,190	26,232	26,277	26,326	26,379	26,435	26,497	26,565
Lucas	43,835	43,856	43,887	43,917	43,955	43,995	44,040	44,088	44,137	44,189	44,246
Mahoning	22,756	22,783	22,816	22,840	22,869	22,901	22,937	22,975	23,017	23,061	23,110
Medina	15,903	15,921	15,943	15,966	15,992	16,021	16,051	16,084	16,120	16,159	16,199
Miami	11,059	11,078	11,094	11,106	11,127	11,150	11,176	11,203	11,233	11,265	11,300
Summit	48,984	49,027	49,077	49,102	49,146	49,193	49,243	49,295	49,351	49,410	49,474

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:		
	7/29	7/30	7/31	8/1	8/3	8/5	8/7
Athens	5,276	5,278	5,280	5,283	5,288 (1,058) [254] {127}	5,294 (1,059) [254] {127}	5,301 (1,060) [254] {127}
Cuyahoga	117,484	117,600	117,713	117,801	118,050 (23,610) [5,666] {2,833}	118,335 (23,667) [5,680] {2,840}	118,664 (23,733) [5,696] {2,848}
Franklin	130,709	130,816	130,973	131,036	131,340 (26,268) [6,304] {3,152}	131,689 (26,338) [6,321] {3,161}	132,093 (26,419) [6,340] {3,170}
Hamilton	82,619	82,697	82,804	82,870	83,083 (16,617) [3,988] {1,994}	83,328 (16,666) [4,000] {2,000}	83,606 (16,721) [4,013] {2,007}
Lake	21,509	21,524	21,538	21,548	21,582 (4,316) [1,036] {518}	21,618 (4,324) [1,038] {519}	21,657 (4,331) [1,040] {520}
Lorain	26,104	26,135	26,166	26,190	26,277 (5,255) [1,261] {631}	26,379 (5,276) [1,266] {633}	26,497 (5,299) [1,272] {636}
Lucas	43,835	43,856	43,887	43,917	43,995 (8,799) [2,112] {1,056}	44,088 (8,818) [2,116] {1,058}	44,189 (8,838) [2,121] {1,061}
Mahoning	22,756	22,783	22,816	22,840	22,901 (4,580) [1,099] {550}	22,975 (4,595) [1,103] {551}	23,061 (4,612) [1,107] {553}
Medina	15,903	15,921	15,943	15,966	16,021 (3,204) [769] {385}	16,084 (3,217) [772] {386}	16,159 (3,232) [776] {388}
Miami	11,059	11,078	11,094	11,106	11,150 (2,230) [535] {268}	11,203 (2,241) [538] {269}	11,265 (2,253) [541] {270}
Summit	48,984	49,027	49,077	49,102	49,193 (9,839) [2,361] {1,181}	49,295 (9,859) [2,366] {1,183}	49,410 (9,882) [2,372] {1,186}

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.