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

Date: 7/19/21

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 7/19/21 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.

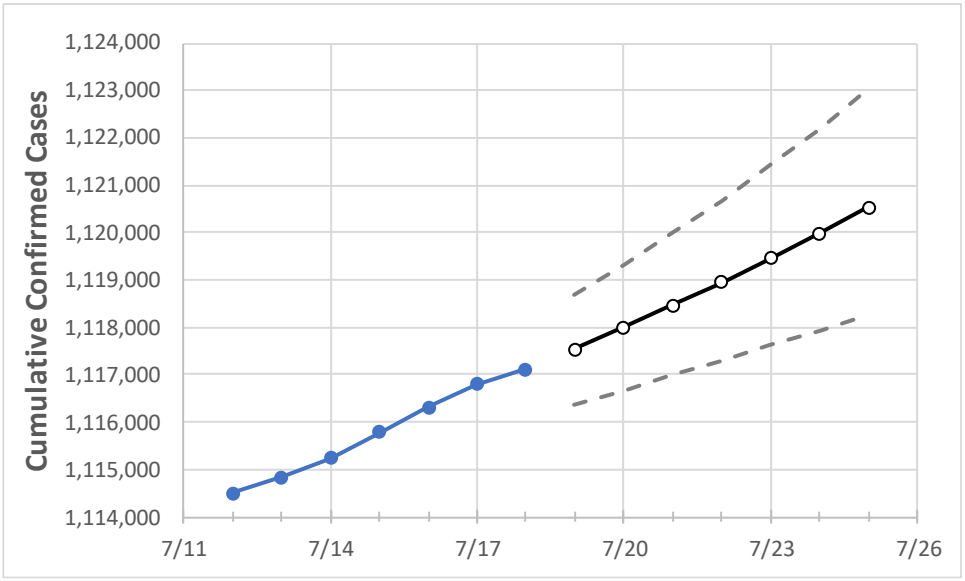
IEM's Modeling Lead

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:						
	7/15	7/16	7/17	7/18	7/19	7/20	7/21	7/22	7/23	7/24	7/25
Ohio	1,115,789	1,116,322	1,116,808	1,117,109	1,117,547	1,118,004	1,118,469	1,118,948	1,119,467	1,119,990	1,120,534

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:						
	7/15	7/16	7/17	7/18	7/19	7/20	7/21	7/22	7/23	7/24	7/25
Athens	5,253	5,254	5,255	5,255	5,256	5,257	5,258	5,258	5,259	5,260	5,261
Cuyahoga	116,485	116,538	116,585	116,617	116,662	116,708	116,755	116,805	116,856	116,909	116,963
Franklin	129,600	129,657	129,696	129,725	129,767	129,811	129,857	129,904	129,952	130,000	130,050
Hamilton	81,826	81,861	81,907	81,926	81,960	81,997	82,034	82,073	82,114	82,157	82,200
Lake	21,340	21,351	21,359	21,361	21,371	21,381	21,392	21,403	21,415	21,428	21,441
Lorain	25,796	25,806	25,818	25,826	25,835	25,845	25,854	25,865	25,876	25,887	25,899
Lucas	43,533	43,545	43,562	43,570	43,581	43,593	43,605	43,617	43,631	43,644	43,658
Mahoning	22,475	22,484	22,487	22,499	22,504	22,509	22,514	22,519	22,524	22,529	22,534
Medina	15,717	15,727	15,730	15,739	15,746	15,753	15,760	15,768	15,776	15,785	15,794
Miami	10,908	10,915	10,920	10,923	10,928	10,932	10,937	10,943	10,948	10,954	10,960
Summit	48,660	48,679	48,689	48,699	48,714	48,730	48,747	48,764	48,782	48,800	48,819

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:		
	7/15	7/16	7/17	7/18	7/20	7/22	7/24
Athens	5,253	5,254	5,255	5,255	5,257 (1,051) [252] {126}	5,258 (1,052) [252] {126}	5,260 (1,052) [252] {126}
Cuyahoga	116,485	116,538	116,585	116,617	116,708 (23,342) [5,602] {2,801}	116,805 (23,361) [5,607] {2,803}	116,909 (23,382) [5,612] {2,806}
Franklin	129,600	129,657	129,696	129,725	129,811 (25,962) [6,231] {3,115}	129,904 (25,981) [6,235] {3,118}	130,000 (26,000) [6,240] {3,120}
Hamilton	81,826	81,861	81,907	81,926	81,997 (16,399) [3,936] {1,968}	82,073 (16,415) [3,939] {1,970}	82,157 (16,431) [3,944] {1,972}
Lake	21,340	21,351	21,359	21,361	21,381 (4,276) [1,026] {513}	21,403 (4,281) [1,027] {514}	21,428 (4,286) [1,029] {514}
Lorain	25,796	25,806	25,818	25,826	25,845 (5,169) [1,241] {620}	25,865 (5,173) [1,242] {621}	25,887 (5,177) [1,243] {621}
Lucas	43,533	43,545	43,562	43,570	43,593 (8,719) [2,092] {1,046}	43,617 (8,723) [2,094] {1,047}	43,644 (8,729) [2,095] {1,047}
Mahoning	22,475	22,484	22,487	22,499	22,509 (4,502) [1,080] {540}	22,519 (4,504) [1,081] {540}	22,529 (4,506) [1,081] {541}
Medina	15,717	15,727	15,730	15,739	15,753 (3,151) [756] {378}	15,768 (3,154) [757] {378}	15,785 (3,157) [758] {379}
Miami	10,908	10,915	10,920	10,923	10,932 (2,186) [525] {262}	10,943 (2,189) [525] {263}	10,954 (2,191) [526] {263}
Summit	48,660	48,679	48,689	48,699	48,730 (9,746) [2,339] {1,170}	48,764 (9,753) [2,341] {1,170}	48,800 (9,760) [2,342] {1,171}

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.