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

Date: 7/16/21

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 7/16/21 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.

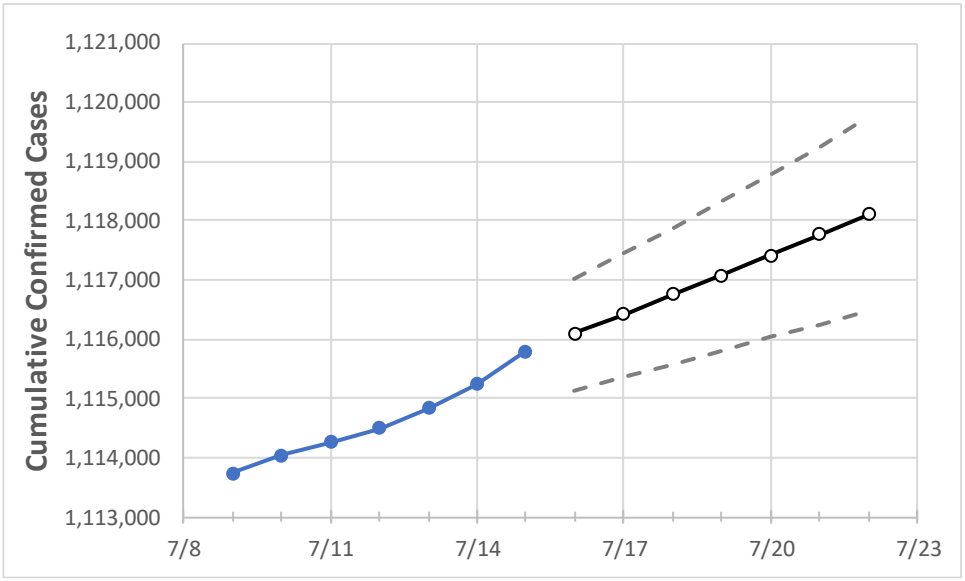
IEM's Modeling Lead

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:						
	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20	7/21	7/22
Ohio	1,114,491	1,114,835	1,115,242	1,115,789	1,116,102	1,116,424	1,116,752	1,117,084	1,117,422	1,117,769	1,118,109

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:						
	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20	7/21	7/22
Athens	5,252	5,251	5,252	5,253	5,254	5,255	5,256	5,257	5,257	5,258	5,259
Cuyahoga	116,330	116,366	116,404	116,485	116,515	116,544	116,575	116,606	116,636	116,667	116,696
Franklin	129,463	129,489	129,531	129,600	129,634	129,670	129,708	129,746	129,785	129,826	129,867
Hamilton	81,743	81,768	81,796	81,826	81,850	81,874	81,900	81,926	81,953	81,980	82,007
Lake	21,314	21,323	21,330	21,340	21,349	21,358	21,368	21,378	21,389	21,400	21,412
Lorain	25,773	25,778	25,782	25,796	25,801	25,806	25,812	25,817	25,822	25,828	25,833
Lucas	43,498	43,509	43,516	43,533	43,539	43,546	43,552	43,559	43,565	43,571	43,578
Mahoning	22,469	22,470	22,473	22,475	22,478	22,481	22,484	22,487	22,490	22,492	22,495
Medina	15,700	15,702	15,712	15,717	15,723	15,728	15,734	15,740	15,746	15,752	15,759
Miami	10,895	10,902	10,904	10,908	10,911	10,914	10,917	10,920	10,923	10,927	10,930
Summit	48,603	48,620	48,641	48,660	48,670	48,681	48,693	48,704	48,715	48,727	48,739

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:		
	7/12	7/13	7/14	7/15	7/17	7/19	7/21
Athens	5,252	5,251	5,252	5,253	5,255 (1,051) [252] {126}	5,257 (1,051) [252] {126}	5,258 (1,052) [252] {126}
Cuyahoga	116,330	116,366	116,404	116,485	116,544 (23,309) [5,594] {2,797}	116,606 (23,321) [5,597] {2,799}	116,667 (23,333) [5,600] {2,800}
Franklin	129,463	129,489	129,531	129,600	129,670 (25,934) [6,224] {3,112}	129,746 (25,949) [6,228] {3,114}	129,826 (25,965) [6,232] {3,116}
Hamilton	81,743	81,768	81,796	81,826	81,874 (16,375) [3,930] {1,965}	81,926 (16,385) [3,932] {1,966}	81,980 (16,396) [3,935] {1,968}
Lake	21,314	21,323	21,330	21,340	21,358 (4,272) [1,025] {513}	21,378 (4,276) [1,026] {513}	21,400 (4,280) [1,027] {514}
Lorain	25,773	25,778	25,782	25,796	25,806 (5,161) [1,239] {619}	25,817 (5,163) [1,239] {620}	25,828 (5,166) [1,240] {620}
Lucas	43,498	43,509	43,516	43,533	43,546 (8,709) [2,090] {1,045}	43,559 (8,712) [2,091] {1,045}	43,571 (8,714) [2,091] {1,046}
Mahoning	22,469	22,470	22,473	22,475	22,481 (4,496) [1,079] {540}	22,487 (4,497) [1,079] {540}	22,492 (4,498) [1,080] {540}
Medina	15,700	15,702	15,712	15,717	15,728 (3,146) [755] {377}	15,740 (3,148) [756] {378}	15,752 (3,150) [756] {378}
Miami	10,895	10,902	10,904	10,908	10,914 (2,183) [524] {262}	10,920 (2,184) [524] {262}	10,927 (2,185) [524] {262}
Summit	48,603	48,620	48,641	48,660	48,681 (9,736) [2,337] {1,168}	48,704 (9,741) [2,338] {1,169}	48,727 (9,745) [2,339] {1,169}

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.