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

Date: 10/22/21

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 10/22/21 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.

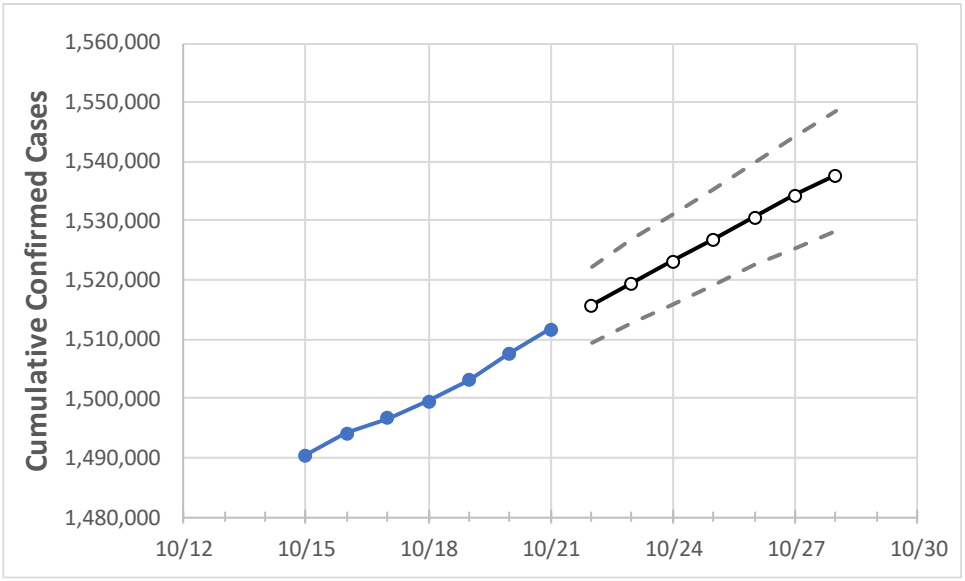
IEM's Modeling Lead

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:						
	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26	10/27	10/28
Ohio	1,499,485	1,503,102	1,507,676	1,511,760	1,515,657	1,519,443	1,523,169	1,526,792	1,530,576	1,534,253	1,537,753

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:						
	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26	10/27	10/28
Athens	7,695	7,704	7,711	7,736	7,753	7,769	7,784	7,799	7,814	7,829	7,844
Cuyahoga	144,766	145,040	145,367	145,725	146,069	146,407	146,732	147,060	147,393	147,724	148,053
Franklin	162,629	162,900	163,303	163,686	163,995	164,289	164,574	164,858	165,155	165,443	165,715
Hamilton	104,476	104,626	104,869	105,042	105,215	105,391	105,555	105,719	105,887	106,048	106,204
Lake	26,669	26,743	26,812	26,907	26,989	27,074	27,156	27,241	27,326	27,410	27,495
Lorain	35,141	35,232	35,313	35,443	35,552	35,655	35,760	35,864	35,970	36,070	36,172
Lucas	55,643	55,753	55,919	56,058	56,214	56,361	56,506	56,652	56,802	56,948	57,089
Mahoning	30,315	30,400	30,493	30,598	30,703	30,806	30,906	31,012	31,113	31,215	31,317
Medina	21,763	21,813	21,865	21,941	21,999	22,054	22,110	22,164	22,218	22,275	22,327
Miami	15,355	15,396	15,459	15,487	15,531	15,571	15,613	15,653	15,695	15,736	15,774
Summit	61,042	61,200	61,343	61,497	61,661	61,815	61,976	62,130	62,285	62,447	62,599

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:		
	10/18	10/19	10/20	10/21	10/23	10/25	10/27
Athens	7,695	7,704	7,711	7,736	7,769 (1,554) [373] {186}	7,799 (1,560) [374] {187}	7,829 (1,566) [376] {188}
Cuyahoga	144,766	145,040	145,367	145,725	146,407 (29,281) [7,028] {3,514}	147,060 (29,412) [7,059] {3,529}	147,724 (29,545) [7,091] {3,545}
Franklin	162,629	162,900	163,303	163,686	164,289 (32,858) [7,886] {3,943}	164,858 (32,972) [7,913] {3,957}	165,443 (33,089) [7,941] {3,971}
Hamilton	104,476	104,626	104,869	105,042	105,391 (21,078) [5,059] {2,529}	105,719 (21,144) [5,075] {2,537}	106,048 (21,210) [5,090] {2,545}
Lake	26,669	26,743	26,812	26,907	27,074 (5,415) [1,300] {650}	27,241 (5,448) [1,308] {654}	27,410 (5,482) [1,316] {658}
Lorain	35,141	35,232	35,313	35,443	35,655 (7,131) [1,711] {856}	35,864 (7,173) [1,721] {861}	36,070 (7,214) [1,731] {866}
Lucas	55,643	55,753	55,919	56,058	56,361 (11,272) [2,705] {1,353}	56,652 (11,330) [2,719] {1,360}	56,948 (11,390) [2,734] {1,367}
Mahoning	30,315	30,400	30,493	30,598	30,806 (6,161) [1,479] {739}	31,012 (6,202) [1,489] {744}	31,215 (6,243) [1,498] {749}
Medina	21,763	21,813	21,865	21,941	22,054 (4,411) [1,059] {529}	22,164 (4,433) [1,064] {532}	22,275 (4,455) [1,069] {535}
Miami	15,355	15,396	15,459	15,487	15,571 (3,114) [747] {374}	15,653 (3,131) [751] {376}	15,736 (3,147) [755] {378}
Summit	61,042	61,200	61,343	61,497	61,815 (12,363) [2,967] {1,484}	62,130 (12,426) [2,982] {1,491}	62,447 (12,489) [2,997] {1,499}

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.