IEM's AI Modeling: Short-term COVID-19 Projections
Date: 10/18/21

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 <u>not</u> 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 10/18/21 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
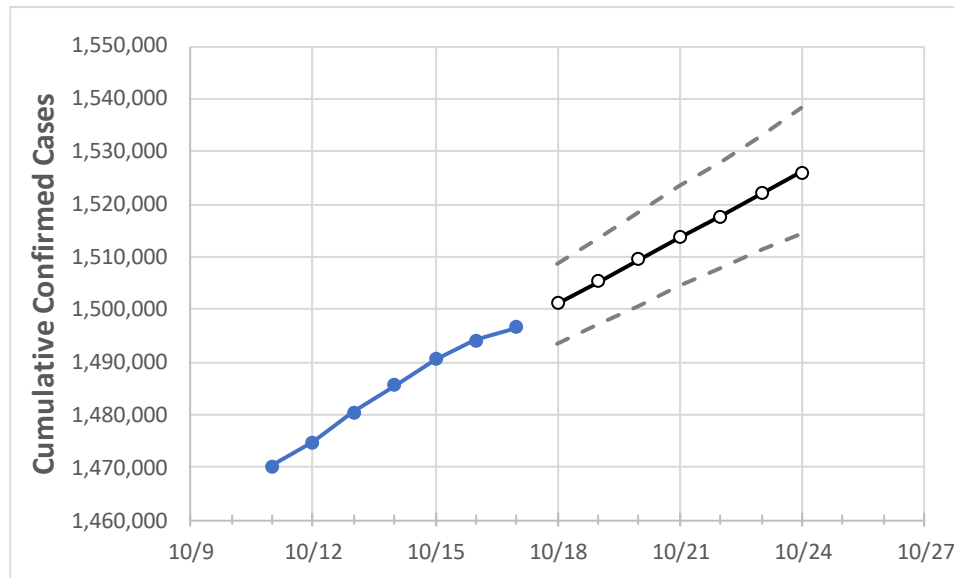
	Actual Confirmed Cases On:				Projected Cases For:						
	10/14	10/15	10/16	10/17	10/18	10/19	10/20	10/21	10/22	10/23	10/24
Ohio	1,485,514	1,490,451	1,494,160	1,496,675	1,501,054	1,505,293	1,509,555	1,513,669	1,517,648	1,521,974	1,525,958

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:						
	10/14	10/15	10/16	10/17	10/18	10/19	10/20	10/21	10/22	10/23	10/24
Athens	7,627	7,653	7,670	7,680	7,700	7,720	7,739	7,758	7,777	7,795	7,814
Cuyahoga	143,542	143,941	144,251	144,542	144,925	145,294	145,664	146,037	146,407	146,780	147,149
Franklin	161,654	162,004	162,302	162,448	162,783	163,103	163,417	163,720	164,032	164,340	164,637
Hamilton	103,798	104,030	104,229	104,360	104,560	104,756	104,949	105,140	105,334	105,519	105,694
Lake	26,352	26,457	26,543	26,609	26,700	26,791	26,882	26,977	27,069	27,166	27,260
Lorain	34,771	34,875	34,972	35,055	35,178	35,302	35,424	35,547	35,667	35,792	35,913
Lucas	55,089	55,296	55,462	55,560	55,729	55,905	56,071	56,239	56,405	56,574	56,740
Mahoning	29,913	30,057	30,168	30,234	30,357	30,475	30,595	30,715	30,834	30,954	31,075
Medina	21,532	21,624	21,673	21,706	21,768	21,829	21,888	21,948	22,004	22,064	22,121
Miami	15,211	15,259	15,305	15,335	15,384	15,432	15,481	15,528	15,575	15,622	15,668
Summit	60,463	60,654	60,792	60,940	61,123	61,301	61,481	61,662	61,842	62,020	62,200

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:		
	10/14	10/15	10/16	10/17	10/19	10/21	10/23
Athens	7,627	7,653	7,670	7,680	7,720 (1,544) [371] {185}	7,758 (1,552) [372] {186}	7,795 (1,559) [374] {187}
Cuyahoga	143,542	143,941	144,251	144,542	145,294 (29,059) [6,974] {3,487}	146,037 (29,207) [7,010] {3,505}	146,780 (29,356) [7,045] {3,523}
Franklin	161,654	162,004	162,302	162,448	163,103 (32,621) [7,829] {3,914}	163,720 (32,744) [7,859] {3,929}	164,340 (32,868) [7,888] {3,944}
Hamilton	103,798	104,030	104,229	104,360	104,756 (20,951) [5,028] {2,514}	105,140 (21,028) [5,047] {2,523}	105,519 (21,104) [5,065] {2,532}
Lake	26,352	26,457	26,543	26,609	26,791 (5,358) [1,286] {643}	26,977 (5,395) [1,295] {647}	27,166 (5,433) [1,304] {652}
Lorain	34,771	34,875	34,972	35,055	35,302 (7,060) [1,694] {847}	35,547 (7,109) [1,706] {853}	35,792 (7,158) [1,718] {859}
Lucas	55,089	55,296	55,462	55,560	55,905 (11,181) [2,683] {1,342}	56,239 (11,248) [2,699] {1,350}	56,574 (11,315) [2,716] {1,358}
Mahoning	29,913	30,057	30,168	30,234	30,475 (6,095) [1,463] {731}	30,715 (6,143) [1,474] {737}	30,954 (6,191) [1,486] {743}
Medina	21,532	21,624	21,673	21,706	21,829 (4,366) [1,048] {524}	21,948 (4,390) [1,053] {527}	22,064 (4,413) [1,059] {530}
Miami	15,211	15,259	15,305	15,335	15,432 (3,086) [741] {370}	15,528 (3,106) [745] {373}	15,622 (3,124) [750] {375}
Summit	60,463	60,654	60,792	60,940	61,301 (12,260) [2,942] {1,471}	61,662 (12,332) [2,960] {1,480}	62,020 (12,404) [2,977] {1,488}

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.