IEM's AI Modeling: Short-term COVID-19 Projections
Date: 12/17/21

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 12/17/21 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
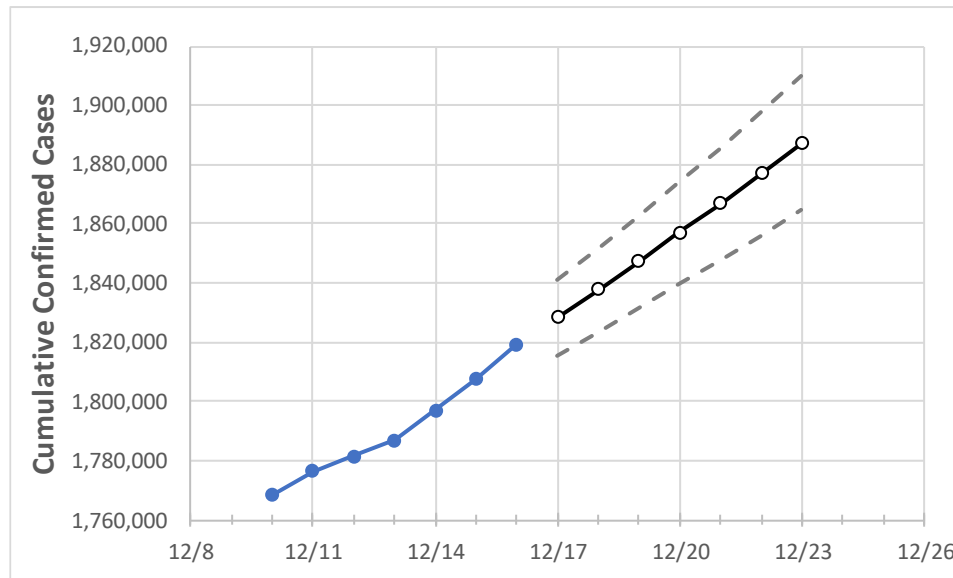
	Actual Confirmed Cases On:				Projected Cases For:						
	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23
Ohio	1,787,029	1,796,951	1,807,539	1,819,342	1,828,510	1,837,952	1,847,393	1,857,018	1,866,833	1,876,956	1,887,239

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:						
	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23
Athens	8,563	8,591	8,613	8,644	8,668	8,691	8,715	8,739	8,764	8,789	8,815
Cuyahoga	177,890	179,268	181,473	184,161	185,794	187,465	189,275	191,092	192,961	194,920	196,948
Franklin	184,748	185,439	186,244	186,992	187,656	188,333	189,019	189,737	190,430	191,136	191,865
Hamilton	117,103	118,417	118,872	120,052	120,714	121,381	122,105	122,851	123,618	124,419	125,290
Lake	34,055	34,279	34,513	34,809	35,019	35,230	35,442	35,656	35,874	36,096	36,321
Lorain	44,609	44,811	45,100	45,453	45,716	45,992	46,264	46,537	46,804	47,089	47,374
Lucas	65,314	65,575	65,882	66,092	66,339	66,592	66,843	67,086	67,340	67,603	67,862
Mahoning	37,199	37,360	37,527	37,712	37,863	38,015	38,168	38,316	38,467	38,622	38,777
Medina	27,363	27,539	27,694	27,865	28,021	28,173	28,330	28,484	28,639	28,801	28,961
Miami	17,977	18,047	18,111	18,188	18,270	18,352	18,434	18,521	18,608	18,697	18,787
Summit	75,540	75,936	76,483	77,118	77,582	78,040	78,513	78,987	79,469	79,974	80,463

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:		
	12/13	12/14	12/15	12/16	12/18	12/20	12/22
Athens	8,563	8,591	8,613	8,644	8,691 (1,738) [417] {209}	8,739 (1,748) [419] {210}	8,789 (1,758) [422] {211}
Cuyahoga	177,890	179,268	181,473	184,161	187,465 (37,493) [8,998] {4,499}	191,092 (38,218) [9,172] {4,586}	194,920 (38,984) [9,356] {4,678}
Franklin	184,748	185,439	186,244	186,992	188,333 (37,667) [9,040] {4,520}	189,737 (37,947) [9,107] {4,554}	191,136 (38,227) [9,175] {4,587}
Hamilton	117,103	118,417	118,872	120,052	121,381 (24,276) [5,826] {2,913}	122,851 (24,570) [5,897] {2,948}	124,419 (24,884) [5,972] {2,986}
Lake	34,055	34,279	34,513	34,809	35,230 (7,046) [1,691] {846}	35,656 (7,131) [1,712] {856}	36,096 (7,219) [1,733] {866}
Lorain	44,609	44,811	45,100	45,453	45,992 (9,198) [2,208] {1,104}	46,537 (9,307) [2,234] {1,117}	47,089 (9,418) [2,260] {1,130}
Lucas	65,314	65,575	65,882	66,092	66,592 (13,318) [3,196] {1,598}	67,086 (13,417) [3,220] {1,610}	67,603 (13,521) [3,245] {1,622}
Mahoning	37,199	37,360	37,527	37,712	38,015 (7,603) [1,825] {912}	38,316 (7,663) [1,839] {920}	38,622 (7,724) [1,854] {927}
Medina	27,363	27,539	27,694	27,865	28,173 (5,635) [1,352] {676}	28,484 (5,697) [1,367] {684}	28,801 (5,760) [1,382] {691}
Miami	17,977	18,047	18,111	18,188	18,352 (3,670) [881] {440}	18,521 (3,704) [889] {444}	18,697 (3,739) [897] {449}
Summit	75,540	75,936	76,483	77,118	78,040 (15,608) [3,746] {1,873}	78,987 (15,797) [3,791] {1,896}	79,974 (15,995) [3,839] {1,919}

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.