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

Date: 9/8/21

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 9/8/21 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.

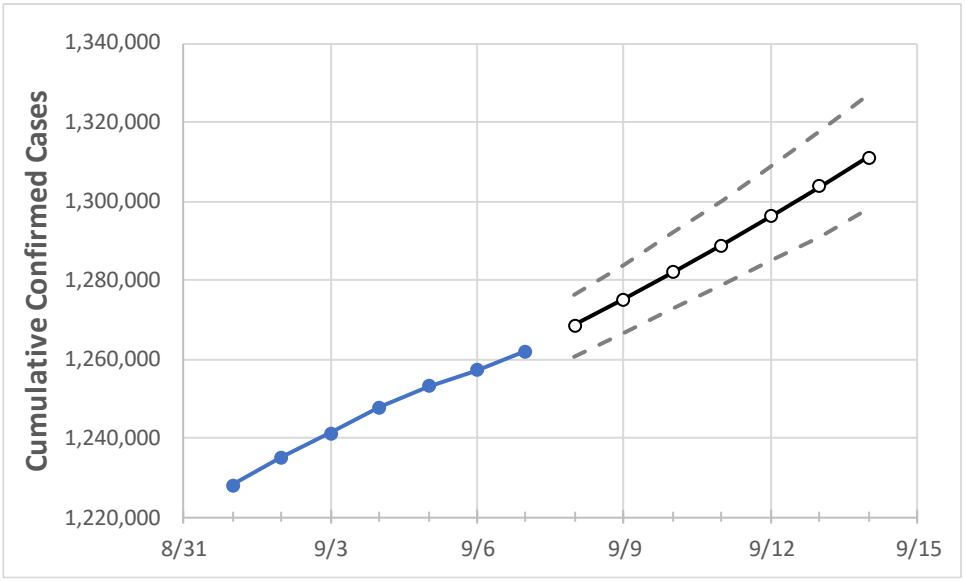
IEM's Modeling Lead

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:						
	9/4	9/5	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14
Ohio	1,247,637	1,253,198	1,257,142	1,262,018	1,268,464	1,275,085	1,281,849	1,288,896	1,296,057	1,303,629	1,311,085

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:						
	9/4	9/5	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14
Athens	6,132	6,170	6,205	6,229	6,305	6,383	6,468	6,555	6,649	6,748	6,851
Cuyahoga	126,461	126,758	127,043	127,496	127,915	128,342	128,779	129,225	129,678	130,155	130,629
Franklin	142,106	142,532	142,864	143,212	143,752	144,299	144,836	145,406	145,990	146,579	147,211
Hamilton	90,700	91,192	91,384	91,634	92,066	92,474	92,906	93,355	93,815	94,291	94,765
Lake	23,244	23,302	23,337	23,411	23,485	23,561	23,634	23,712	23,791	23,871	23,950
Lorain	28,701	28,792	28,949	29,089	29,232	29,380	29,535	29,693	29,859	30,027	30,203
Lucas	47,256	47,464	47,581	47,711	47,893	48,081	48,271	48,465	48,664	48,876	49,087
Mahoning	24,688	24,764	24,839	24,945	25,042	25,140	25,241	25,343	25,445	25,555	25,663
Medina	17,962	18,056	18,147	18,278	18,405	18,534	18,670	18,808	18,954	19,104	19,261
Miami	12,496	12,574	12,611	12,658	12,724	12,792	12,860	12,931	13,001	13,077	13,149
Summit	52,809	52,944	53,049	53,261	53,450	53,646	53,846	54,052	54,264	54,484	54,710

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:		
	9/4	9/5	9/6	9/7	9/9	9/11	9/13
Athens	6,132	6,170	6,205	6,229	6,383 (1,277) [306] {153}	6,555 (1,311) [315] {157}	6,748 (1,350) [324] {162}
Cuyahoga	126,461	126,758	127,043	127,496	128,342 (25,668) [6,160] {3,080}	129,225 (25,845) [6,203] {3,101}	130,155 (26,031) [6,247] {3,124}
Franklin	142,106	142,532	142,864	143,212	144,299 (28,860) [6,926] {3,463}	145,406 (29,081) [6,980] {3,490}	146,579 (29,316) [7,036] {3,518}
Hamilton	90,700	91,192	91,384	91,634	92,474 (18,495) [4,439] {2,219}	93,355 (18,671) [4,481] {2,241}	94,291 (18,858) [4,526] {2,263}
Lake	23,244	23,302	23,337	23,411	23,561 (4,712) [1,131] {565}	23,712 (4,742) [1,138] {569}	23,871 (4,774) [1,146] {573}
Lorain	28,701	28,792	28,949	29,089	29,380 (5,876) [1,410] {705}	29,693 (5,939) [1,425] {713}	30,027 (6,005) [1,441] {721}
Lucas	47,256	47,464	47,581	47,711	48,081 (9,616) [2,308] {1,154}	48,465 (9,693) [2,326] {1,163}	48,876 (9,775) [2,346] {1,173}
Mahoning	24,688	24,764	24,839	24,945	25,140 (5,028) [1,207] {603}	25,343 (5,069) [1,216] {608}	25,555 (5,111) [1,227] {613}
Medina	17,962	18,056	18,147	18,278	18,534 (3,707) [890] {445}	18,808 (3,762) [903] {451}	19,104 (3,821) [917] {459}
Miami	12,496	12,574	12,611	12,658	12,792 (2,558) [614] {307}	12,931 (2,586) [621] {310}	13,077 (2,615) [628] {314}
Summit	52,809	52,944	53,049	53,261	53,646 (10,729) [2,575] {1,287}	54,052 (10,810) [2,595] {1,297}	54,484 (10,897) [2,615] {1,308}

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.