IEM's AI Modeling: Short-term COVID-19 Projections
Date: 2/4/21

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 2/4/21 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
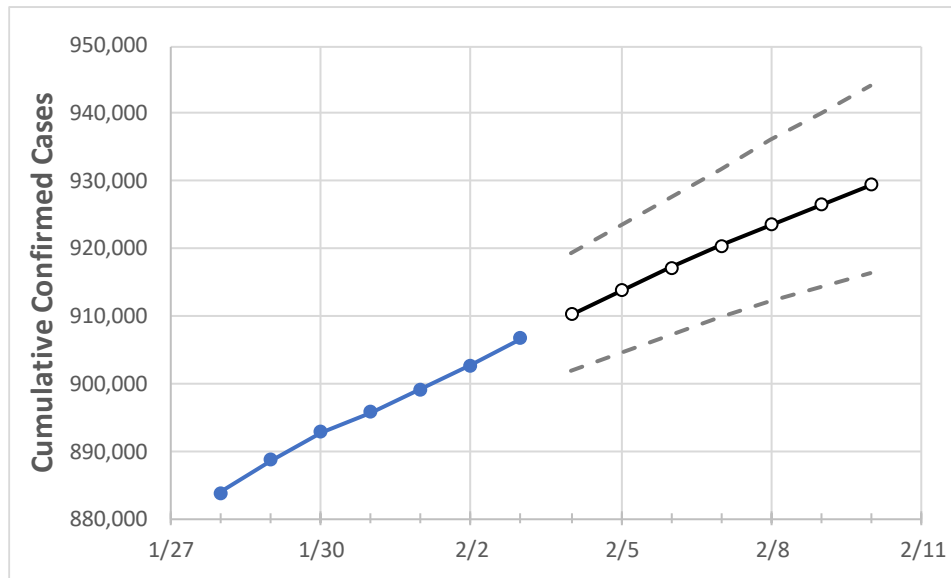
	Actual Confirmed Cases On:				Projected Cases For:						
	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8	2/9	2/10
Ohio	895,792	899,079	902,736	906,727	910,289	913,761	917,132	920,359	923,568	926,530	929,502

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:						
	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8	2/9	2/10
Athens	4,027	4,060	4,089	4,127	4,155	4,184	4,212	4,241	4,270	4,297	4,325
Cuyahoga	89,042	89,371	89,554	89,881	90,204	90,505	90,798	91,078	91,349	91,612	91,866
Franklin	104,761	105,102	105,457	105,796	106,141	106,468	106,784	107,088	107,379	107,647	107,916
Hamilton	67,154	67,394	67,772	68,156	68,498	68,824	69,140	69,455	69,765	70,066	70,365
Lake	16,807	16,867	16,931	17,044	17,118	17,189	17,261	17,329	17,395	17,458	17,521
Lorain	20,012	20,107	20,199	20,311	20,410	20,510	20,606	20,696	20,785	20,872	20,957
Lucas	32,637	32,747	32,852	32,974	33,098	33,217	33,332	33,444	33,555	33,662	33,766
Mahoning	17,999	18,058	18,135	18,229	18,304	18,376	18,450	18,522	18,592	18,663	18,730
Medina	12,138	12,189	12,285	12,341	12,401	12,457	12,513	12,567	12,620	12,673	12,725
Miami	9,468	9,489	9,527	9,556	9,586	9,613	9,641	9,667	9,693	9,717	9,740
Summit	36,414	36,541	36,733	36,929	37,087	37,243	37,398	37,547	37,692	37,834	37,968

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: | | |
	1/31	2/1	2/2	2/3	2/5	2/7	2/9
Athens	4,027	4,060	4,089	4,127	4,184 (837) [201] {100}	4,241 (848) [204] {102}	4,297 (859) [206] {103}
Cuyahoga	89,042	89,371	89,554	89,881	90,505 (18,101) [4,344] {2,172}	91,078 (18,216) [4,372] {2,186}	91,612 (18,322) [4,397] {2,199}
Franklin	104,761	105,102	105,457	105,796	106,468 (21,294) [5,110] {2,555}	107,088 (21,418) [5,140] {2,570}	107,647 (21,529) [5,167] {2,584}
Hamilton	67,154	67,394	67,772	68,156	68,824 (13,765) [3,304] {1,652}	69,455 (13,891) [3,334] {1,667}	70,066 (14,013) [3,363] {1,682}
Lake	16,807	16,867	16,931	17,044	17,189 (3,438) [825] {413}	17,329 (3,466) [832] {416}	17,458 (3,492) [838] {419}
Lorain	20,012	20,107	20,199	20,311	20,510 (4,102) [984] {492}	20,696 (4,139) [993] {497}	20,872 (4,174) [1,002] {501}
Lucas	32,637	32,747	32,852	32,974	33,217 (6,643) [1,594] {797}	33,444 (6,689) [1,605] {803}	33,662 (6,732) [1,616] {808}
Mahoning	17,999	18,058	18,135	18,229	18,376 (3,675) [882] {441}	18,522 (3,704) [889] {445}	18,663 (3,733) [896] {448}
Medina	12,138	12,189	12,285	12,341	12,457 (2,491) [598] {299}	12,567 (2,513) [603] {302}	12,673 (2,535) [608] {304}
Miami	9,468	9,489	9,527	9,556	9,613 (1,923) [461] {231}	9,667 (1,933) [464] {232}	9,717 (1,943) [466] {233}
Summit	36,414	36,541	36,733	36,929	37,243 (7,449) [1,788] {894}	37,547 (7,509) [1,802] {901}	37,834 (7,567) [1,816] {908}

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.