IEM's AI Modeling: Short-term COVID-19 Projections
Date: 2/11/21

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 2/11/21 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
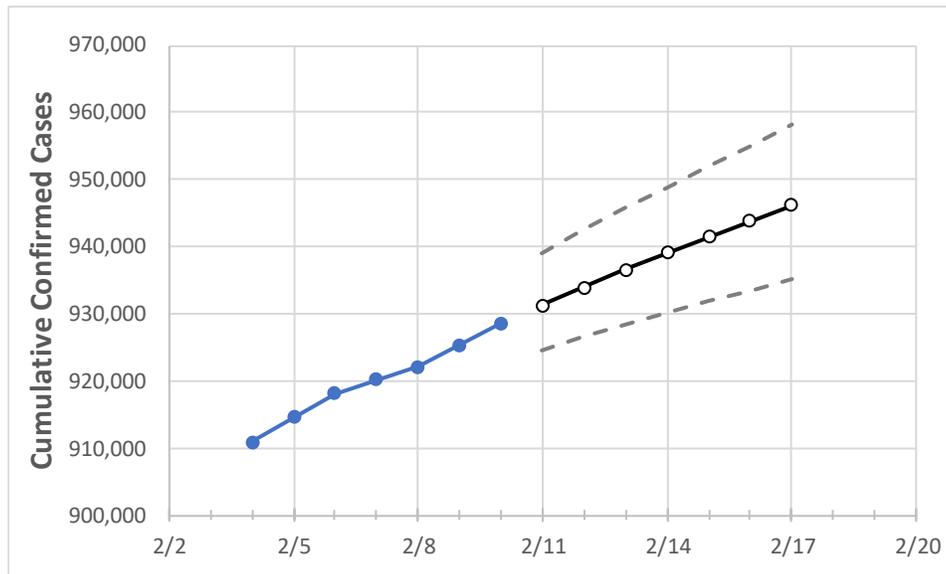
	Actual Confirmed Cases On:				Projected Cases For:						
	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17
Ohio	920,217	922,143	925,350	928,631	931,329	933,993	936,638	939,091	941,494	943,837	946,131

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:						
	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17
Athens	4,221	4,230	4,263	4,290	4,316	4,341	4,367	4,392	4,416	4,441	4,465
Cuyahoga	91,144	91,318	91,474	91,739	91,956	92,159	92,357	92,544	92,723	92,893	93,054
Franklin	107,107	107,282	107,627	107,954	108,208	108,444	108,678	108,904	109,122	109,323	109,519
Hamilton	69,411	69,562	69,858	70,101	70,349	70,590	70,827	71,053	71,275	71,484	71,694
Lake	17,340	17,371	17,454	17,516	17,574	17,630	17,684	17,736	17,786	17,835	17,882
Lorain	20,672	20,717	20,801	20,915	20,988	21,061	21,132	21,199	21,263	21,326	21,388
Lucas	33,414	33,471	33,564	33,665	33,751	33,835	33,914	33,992	34,063	34,133	34,199
Mahoning	18,470	18,530	18,579	18,658	18,717	18,773	18,830	18,885	18,939	18,990	19,043
Medina	12,557	12,592	12,641	12,689	12,736	12,782	12,826	12,870	12,913	12,954	12,994
Miami	9,673	9,684	9,719	9,741	9,764	9,786	9,807	9,828	9,848	9,867	9,886
Summit	37,622	37,749	37,898	38,074	38,219	38,359	38,498	38,630	38,765	38,892	39,018

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: | | |
	2/7	2/8	2/9	2/10	2/12	2/14	2/16
Athens	4,221	4,230	4,263	4,290	4,341 (868) [208] {104}	4,392 (878) [211] {105}	4,441 (888) [213] {107}
Cuyahoga	91,144	91,318	91,474	91,739	92,159 (18,432) [4,424] {2,212}	92,544 (18,509) [4,442] {2,221}	92,893 (18,579) [4,459] {2,229}
Franklin	107,107	107,282	107,627	107,954	108,444 (21,689) [5,205] {2,603}	108,904 (21,781) [5,227] {2,614}	109,323 (21,865) [5,247] {2,624}
Hamilton	69,411	69,562	69,858	70,101	70,590 (14,118) [3,388] {1,694}	71,053 (14,211) [3,411] {1,705}	71,484 (14,297) [3,431] {1,716}
Lake	17,340	17,371	17,454	17,516	17,630 (3,526) [846] {423}	17,736 (3,547) [851] {426}	17,835 (3,567) [856] {428}
Lorain	20,672	20,717	20,801	20,915	21,061 (4,212) [1,011] {505}	21,199 (4,240) [1,018] {509}	21,326 (4,265) [1,024] {512}
Lucas	33,414	33,471	33,564	33,665	33,835 (6,767) [1,624] {812}	33,992 (6,798) [1,632] {816}	34,133 (6,827) [1,638] {819}
Mahoning	18,470	18,530	18,579	18,658	18,773 (3,755) [901] {451}	18,885 (3,777) [906] {453}	18,990 (3,798) [912] {456}
Medina	12,557	12,592	12,641	12,689	12,782 (2,556) [614] {307}	12,870 (2,574) [618] {309}	12,954 (2,591) [622] {311}
Miami	9,673	9,684	9,719	9,741	9,786 (1,957) [470] {235}	9,828 (1,966) [472] {236}	9,867 (1,973) [474] {237}
Summit	37,622	37,749	37,898	38,074	38,359 (7,672) [1,841] {921}	38,630 (7,726) [1,854] {927}	38,892 (7,778) [1,867] {933}

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.