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

Date: 4/14/21

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 4/14/21 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.

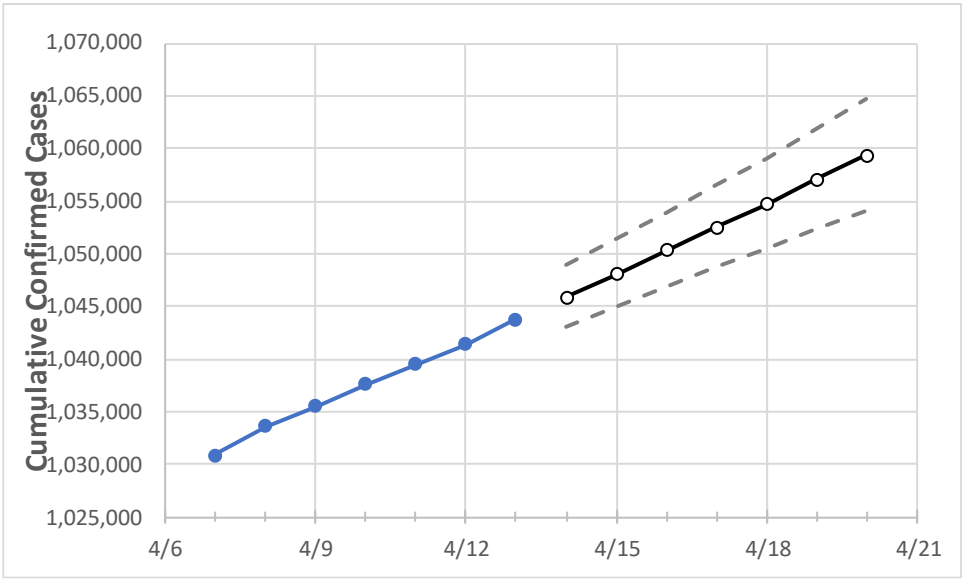
IEM's Modeling Lead

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:						
	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20
Ohio	1,037,600	1,039,455	1,041,389	1,043,729	1,045,899	1,048,069	1,050,298	1,052,512	1,054,732	1,057,020	1,059,315

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:						
	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20
Athens	4,936	4,948	4,958	4,966	4,978	4,991	5,003	5,016	5,029	5,043	5,057
Cuyahoga	104,849	105,180	105,470	105,771	106,094	106,430	106,774	107,116	107,468	107,826	108,189
Franklin	120,346	120,536	120,804	121,133	121,406	121,679	121,960	122,236	122,521	122,810	123,101
Hamilton	77,422	77,499	77,595	77,720	77,823	77,925	78,027	78,130	78,232	78,334	78,437
Lake	19,698	19,760	19,802	19,839	19,894	19,951	20,010	20,070	20,133	20,196	20,262
Lorain	23,775	23,831	23,887	23,968	24,035	24,103	24,172	24,244	24,317	24,391	24,469
Lucas	39,105	39,235	39,366	39,537	39,688	39,843	40,003	40,168	40,335	40,506	40,685
Mahoning	20,622	20,653	20,699	20,745	20,790	20,835	20,881	20,928	20,977	21,026	21,076
Medina	14,662	14,693	14,727	14,758	14,789	14,819	14,849	14,880	14,910	14,940	14,971
Miami	10,455	10,470	10,480	10,484	10,495	10,506	10,517	10,528	10,540	10,551	10,563
Summit	44,494	44,613	44,761	44,890	45,025	45,162	45,300	45,437	45,576	45,717	45,862

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:		
	4/10	4/11	4/12	4/13	4/15	4/17	4/19
Athens	4,936	4,948	4,958	4,966	4,991 (998) [240] {120}	5,016 (1,003) [241] {120}	5,043 (1,009) [242] {121}
Cuyahoga	104,849	105,180	105,470	105,771	106,430 (21,286) [5,109] {2,554}	107,116 (21,423) [5,142] {2,571}	107,826 (21,565) [5,176] {2,588}
Franklin	120,346	120,536	120,804	121,133	121,679 (24,336) [5,841] {2,920}	122,236 (24,447) [5,867] {2,934}	122,810 (24,562) [5,895] {2,947}
Hamilton	77,422	77,499	77,595	77,720	77,925 (15,585) [3,740] {1,870}	78,130 (15,626) [3,750] {1,875}	78,334 (15,667) [3,760] {1,880}
Lake	19,698	19,760	19,802	19,839	19,951 (3,990) [958] {479}	20,070 (4,014) [963] {482}	20,196 (4,039) [969] {485}
Lorain	23,775	23,831	23,887	23,968	24,103 (4,821) [1,157] {578}	24,244 (4,849) [1,164] {582}	24,391 (4,878) [1,171] {585}
Lucas	39,105	39,235	39,366	39,537	39,843 (7,969) [1,912] {956}	40,168 (8,034) [1,928] {964}	40,506 (8,101) [1,944] {972}
Mahoning	20,622	20,653	20,699	20,745	20,835 (4,167) [1,000] {500}	20,928 (4,186) [1,005] {502}	21,026 (4,205) [1,009] {505}
Medina	14,662	14,693	14,727	14,758	14,819 (2,964) [711] {356}	14,880 (2,976) [714] {357}	14,940 (2,988) [717] {359}
Miami	10,455	10,470	10,480	10,484	10,506 (2,101) [504] {252}	10,528 (2,106) [505] {253}	10,551 (2,110) [506] {253}
Summit	44,494	44,613	44,761	44,890	45,162 (9,032) [2,168] {1,084}	45,437 (9,087) [2,181] {1,090}	45,717 (9,143) [2,194] {1,097}

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.