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

Date: 3/10/21

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 3/10/21 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.

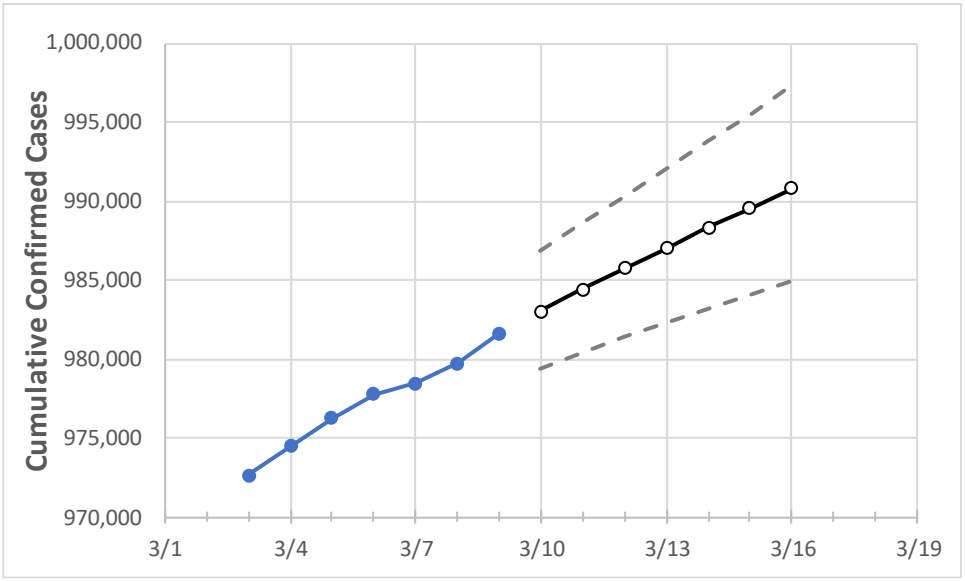
IEM's Modeling Lead

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:						
	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16
Ohio	977,736	978,471	979,725	981,618	983,042	984,400	985,726	987,030	988,311	989,562	990,785

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:						
	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16
Athens	4,661	4,664	4,671	4,678	4,682	4,686	4,690	4,694	4,697	4,701	4,703
Cuyahoga	96,856	96,933	97,121	97,369	97,571	97,780	97,992	98,210	98,411	98,616	98,818
Franklin	112,955	113,037	113,218	113,458	113,625	113,793	113,956	114,121	114,284	114,441	114,598
Hamilton	73,882	73,923	73,990	74,112	74,194	74,276	74,351	74,425	74,495	74,564	74,630
Lake	18,545	18,564	18,602	18,635	18,662	18,688	18,714	18,738	18,762	18,785	18,806
Lorain	22,190	22,218	22,242	22,314	22,345	22,376	22,407	22,435	22,463	22,490	22,517
Lucas	35,779	35,802	35,853	35,943	36,022	36,097	36,174	36,251	36,327	36,399	36,470
Mahoning	19,578	19,586	19,611	19,632	19,653	19,672	19,691	19,709	19,726	19,744	19,761
Medina	13,517	13,531	13,559	13,604	13,631	13,657	13,683	13,709	13,734	13,759	13,785
Miami	10,059	10,065	10,068	10,077	10,084	10,090	10,097	10,103	10,108	10,114	10,120
Summit	40,668	40,720	40,800	40,879	40,953	41,029	41,102	41,173	41,242	41,312	41,378

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:		
	3/6	3/7	3/8	3/9	3/11	3/13	3/15
Athens	4,661	4,664	4,671	4,678	4,686 (937) [225] {112}	4,694 (939) [225] {113}	4,701 (940) [226] {113}
Cuyahoga	96,856	96,933	97,121	97,369	97,780 (19,556) [4,693] {2,347}	98,210 (19,642) [4,714] {2,357}	98,616 (19,723) [4,734] {2,367}
Franklin	112,955	113,037	113,218	113,458	113,793 (22,759) [5,462] {2,731}	114,121 (22,824) [5,478] {2,739}	114,441 (22,888) [5,493] {2,747}
Hamilton	73,882	73,923	73,990	74,112	74,276 (14,855) [3,565] {1,783}	74,425 (14,885) [3,572] {1,786}	74,564 (14,913) [3,579] {1,790}
Lake	18,545	18,564	18,602	18,635	18,688 (3,738) [897] {449}	18,738 (3,748) [899] {450}	18,785 (3,757) [902] {451}
Lorain	22,190	22,218	22,242	22,314	22,376 (4,475) [1,074] {537}	22,435 (4,487) [1,077] {538}	22,490 (4,498) [1,080] {540}
Lucas	35,779	35,802	35,853	35,943	36,097 (7,219) [1,733] {866}	36,251 (7,250) [1,740] {870}	36,399 (7,280) [1,747] {874}
Mahoning	19,578	19,586	19,611	19,632	19,672 (3,934) [944] {472}	19,709 (3,942) [946] {473}	19,744 (3,949) [948] {474}
Medina	13,517	13,531	13,559	13,604	13,657 (2,731) [656] {328}	13,709 (2,742) [658] {329}	13,759 (2,752) [660] {330}
Miami	10,059	10,065	10,068	10,077	10,090 (2,018) [484] {242}	10,103 (2,021) [485] {242}	10,114 (2,023) [485] {243}
Summit	40,668	40,720	40,800	40,879	41,029 (8,206) [1,969] {985}	41,173 (8,235) [1,976] {988}	41,312 (8,262) [1,983] {991}

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.