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

Date: 2/16/21

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 2/16/21 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.

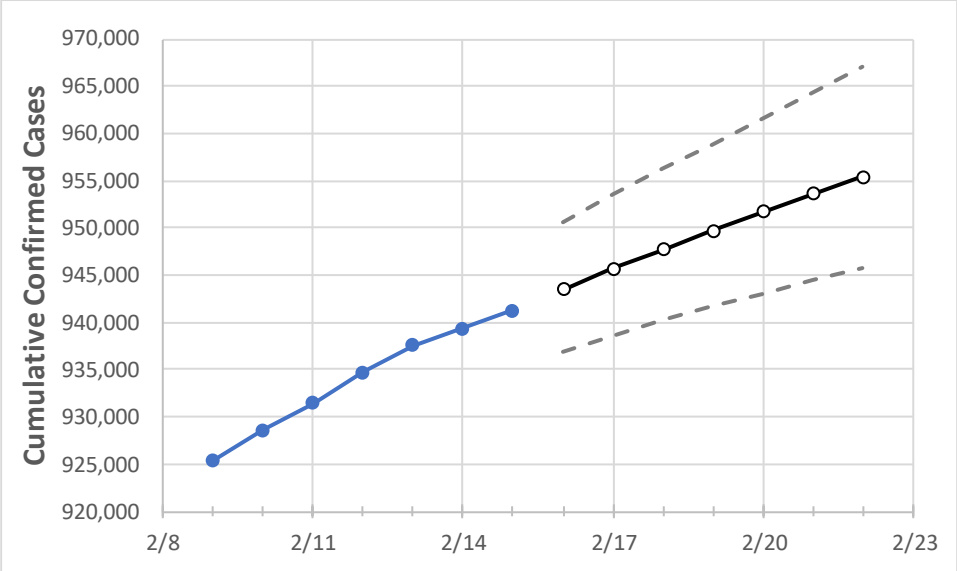
IEM's Modeling Lead

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:						
	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22
Ohio	934,742	937,541	939,350	941,265	943,539	945,667	947,752	949,743	951,687	953,574	955,399

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:						
	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22
Athens	4,359	4,403	4,414	4,438	4,464	4,489	4,514	4,540	4,566	4,592	4,617
Cuyahoga	92,243	92,500	92,699	92,902	93,083	93,255	93,423	93,588	93,748	93,901	94,048
Franklin	108,550	108,800	108,993	109,190	109,406	109,611	109,813	110,008	110,191	110,363	110,529
Hamilton	70,556	70,822	70,979	71,123	71,319	71,506	71,687	71,866	72,042	72,209	72,370
Lake	17,677	17,737	17,777	17,810	17,863	17,914	17,963	18,012	18,058	18,103	18,144
Lorain	21,086	21,152	21,213	21,291	21,357	21,421	21,483	21,542	21,600	21,654	21,709
Lucas	33,877	33,963	34,038	34,075	34,143	34,210	34,276	34,337	34,397	34,453	34,508
Mahoning	18,774	18,817	18,852	18,896	18,942	18,986	19,029	19,071	19,112	19,153	19,191
Medina	12,783	12,835	12,868	12,905	12,945	12,984	13,021	13,057	13,091	13,125	13,157
Miami	9,779	9,801	9,817	9,834	9,852	9,870	9,886	9,902	9,918	9,934	9,948
Summit	38,364	38,509	38,592	38,688	38,806	38,924	39,037	39,148	39,257	39,361	39,460

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:		
	2/12	2/13	2/14	2/15	2/17	2/19	2/21
Athens	4,359	4,403	4,414	4,438	4,489 (898) [215] {108}	4,540 (908) [218] {109}	4,592 (918) [220] {110}
Cuyahoga	92,243	92,500	92,699	92,902	93,255 (18,651) [4,476] {2,238}	93,588 (18,718) [4,492] {2,246}	93,901 (18,780) [4,507] {2,254}
Franklin	108,550	108,800	108,993	109,190	109,611 (21,922) [5,261] {2,631}	110,008 (22,002) [5,280] {2,640}	110,363 (22,073) [5,297] {2,649}
Hamilton	70,556	70,822	70,979	71,123	71,506 (14,301) [3,432] {1,716}	71,866 (14,373) [3,450] {1,725}	72,209 (14,442) [3,466] {1,733}
Lake	17,677	17,737	17,777	17,810	17,914 (3,583) [860] {430}	18,012 (3,602) [865] {432}	18,103 (3,621) [869] {434}
Lorain	21,086	21,152	21,213	21,291	21,421 (4,284) [1,028] {514}	21,542 (4,308) [1,034] {517}	21,654 (4,331) [1,039] {520}
Lucas	33,877	33,963	34,038	34,075	34,210 (6,842) [1,642] {821}	34,337 (6,867) [1,648] {824}	34,453 (6,891) [1,654] {827}
Mahoning	18,774	18,817	18,852	18,896	18,986 (3,797) [911] {456}	19,071 (3,814) [915] {458}	19,153 (3,831) [919] {460}
Medina	12,783	12,835	12,868	12,905	12,984 (2,597) [623] {312}	13,057 (2,611) [627] {313}	13,125 (2,625) [630] {315}
Miami	9,779	9,801	9,817	9,834	9,870 (1,974) [474] {237}	9,902 (1,980) [475] {238}	9,934 (1,987) [477] {238}
Summit	38,364	38,509	38,592	38,688	38,924 (7,785) [1,868] {934}	39,148 (7,830) [1,879] {940}	39,361 (7,872) [1,889] {945}

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.