IEM's AI Modeling: Short-term COVID-19 Projections
Date: 3/15/21

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 <u>not</u> 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 3/15/21 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.

Arizona State Projections
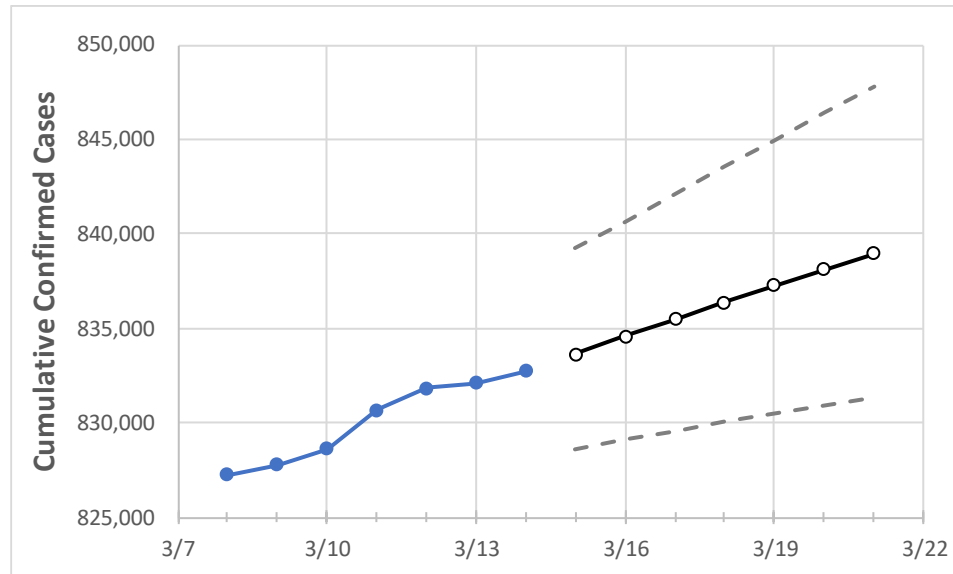
	Actual Confirmed Cases On:				Projected Cases For:						
	3/11	3/12	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21
Arizona	830,655	831,832	832,094	832,743	833,655	834,575	835,484	836,388	837,264	838,102	838,952

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.

Arizona Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	3/11	3/12	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21
Coconino	16,828	16,824	16,851	16,875	16,897	16,918	16,938	16,957	16,977	16,996	17,014
Maricopa	519,285	520,291	520,193	520,487	521,179	521,877	522,572	523,244	523,928	524,594	525,262
Navajo	15,620	15,538	15,560	15,564	15,576	15,587	15,598	15,609	15,620	15,630	15,640
Pima	110,931	111,041	111,115	111,207	111,301	111,392	111,475	111,559	111,638	111,717	111,790
Pinal	47,261	47,376	47,527	47,678	47,784	47,893	48,001	48,109	48,217	48,331	48,446

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.*

Arizona Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	3/11	3/12	3/13	3/14	3/16	3/18	3/20
Coconino	16,828	16,824	16,851	16,875	16,918 (3,384) [812] {406}	16,957 (3,391) [814] {407}	16,996 (3,399) [816] {408}
Maricopa	519,285	520,291	520,193	520,487	521,877 (104,375) [25,050] {12,525}	523,244 (104,649) [25,116] {12,558}	524,594 (104,919) [25,181] {12,590}
Navajo	15,620	15,538	15,560	15,564	15,587 (3,117) [748] {374}	15,609 (3,122) [749] {375}	15,630 (3,126) [750] {375}
Pima	110,931	111,041	111,115	111,207	111,392 (22,278) [5,347] {2,673}	111,559 (22,312) [5,355] {2,677}	111,717 (22,343) [5,362] {2,681}
Pinal	47,261	47,376	47,527	47,678	47,893 (9,579) [2,299] {1,149}	48,109 (9,622) [2,309] {1,155}	48,331 (9,666) [2,320] {1,160}

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.