IEM's AI Modeling: Short-term COVID-19 Projections
Date: 6/7/21

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 6/7/21 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.

Texas State Projections
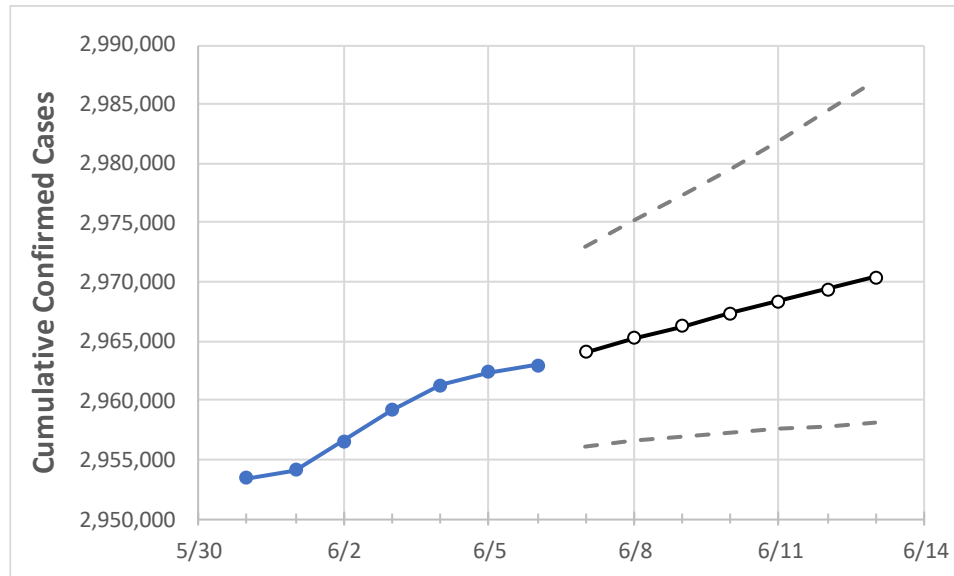
	Actual Confirmed Cases On:				Projected Cases For:						
	6/3	6/4	6/5	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13
Texas	2,959,171	2,961,257	2,962,395	2,962,934	2,964,093	2,965,216	2,966,280	2,967,329	2,968,381	2,969,360	2,970,414

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.

Texas Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	6/3	6/4	6/5	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13
Bexar	224,084	224,185	224,185	224,185	224,349	224,511	224,671	224,832	224,991	225,151	225,312
Brazoria	38,200	38,214	38,231	38,231	38,250	38,270	38,290	38,310	38,330	38,349	38,368
Brazos	27,643	27,663	27,663	27,663	27,680	27,698	27,715	27,733	27,751	27,770	27,788
Collin	91,521	91,521	91,521	91,521	91,541	91,561	91,579	91,595	91,612	91,628	91,642
Dallas	303,645	303,756	303,854	303,854	303,933	304,011	304,085	304,160	304,232	304,303	304,373
Denton	76,237	76,279	76,279	76,279	76,310	76,340	76,370	76,399	76,428	76,456	76,482
El Paso	136,182	136,196	136,208	136,233	136,252	136,270	136,288	136,304	136,320	136,335	136,349
Ellis	23,084	23,088	23,094	23,094	23,102	23,109	23,117	23,124	23,131	23,138	23,145
Fort Bend	68,939	68,993	68,993	68,993	69,034	69,076	69,119	69,159	69,200	69,238	69,278
Galveston	40,469	40,494	40,517	40,551	40,571	40,591	40,610	40,629	40,647	40,664	40,681
Harris	400,692	401,345	401,469	401,812	402,037	402,252	402,460	402,684	402,886	403,103	403,320
Hidalgo	91,653	91,718	91,718	91,718	91,770	91,823	91,869	91,922	91,976	92,027	92,072
Johnson	19,987	19,991	19,998	19,997	20,004	20,012	20,020	20,027	20,034	20,041	20,048
Lubbock	49,358	49,364	49,371	49,371	49,377	49,383	49,388	49,393	49,398	49,402	49,406
McLennan	27,563	27,581	27,592	27,592	27,605	27,619	27,631	27,645	27,657	27,670	27,682
Montgomery	54,623	54,643	54,624	54,624	54,653	54,678	54,703	54,728	54,752	54,775	54,798
Tarrant	260,993	261,124	261,163	261,201	261,252	261,300	261,352	261,397	261,441	261,484	261,529
Travis	83,878	83,910	83,910	83,910	83,935	83,961	83,985	84,007	84,031	84,054	84,077
Williamson	47,027	47,083	47,083	47,083	47,138	47,194	47,251	47,309	47,369	47,430	47,493

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.*

Texas Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	6/3	6/4	6/5	6/6	6/8	6/10	6/12
Bexar	224,084	224,185	224,185	224,185	224,511 (44,902) [10,777] {5,388}	224,832 (44,966) [10,792] {5,396}	225,151 (45,030) [10,807] {5,404}
Brazoria	38,200	38,214	38,231	38,231	38,270 (7,654) [1,837] {918}	38,310 (7,662) [1,839] {919}	38,349 (7,670) [1,841] {920}
Brazos	27,643	27,663	27,663	27,663	27,698 (5,540) [1,329] {665}	27,733 (5,547) [1,331] {666}	27,770 (5,554) [1,333] {666}
Collin	91,521	91,521	91,521	91,521	91,561 (18,312) [4,395] {2,197}	91,595 (18,319) [4,397] {2,198}	91,628 (18,326) [4,398] {2,199}
Dallas	303,645	303,756	303,854	303,854	304,011 (60,802) [14,593] {7,296}	304,160 (60,832) [14,600] {7,300}	304,303 (60,861) [14,607] {7,303}
Denton	76,237	76,279	76,279	76,279	76,340 (15,268) [3,664] {1,832}	76,399 (15,280) [3,667] {1,834}	76,456 (15,291) [3,670] {1,835}
El Paso	136,182	136,196	136,208	136,233	136,270 (27,254) [6,541] {3,270}	136,304 (27,261) [6,543] {3,271}	136,335 (27,267) [6,544] {3,272}
Ellis	23,084	23,088	23,094	23,094	23,109 (4,622) [1,109] {555}	23,124 (4,625) [1,110] {555}	23,138 (4,628) [1,111] {555}
Fort Bend	68,939	68,993	68,993	68,993	69,076 (13,815) [3,316] {1,658}	69,159 (13,832) [3,320] {1,660}	69,238 (13,848) [3,323] {1,662}
Galveston	40,469	40,494	40,517	40,551	40,591 (8,118) [1,948] {974}	40,629 (8,126) [1,950] {975}	40,664 (8,133) [1,952] {976}
Harris	400,692	401,345	401,469	401,812	402,252 (80,450) [19,308] {9,654}	402,684 (80,537) [19,329] {9,664}	403,103 (80,621) [19,349] {9,674}
Hidalgo	91,653	91,718	91,718	91,718	91,823 (18,365) [4,408] {2,204}	91,922 (18,384) [4,412] {2,206}	92,027 (18,405) [4,417] {2,209}
Johnson	19,987	19,991	19,998	19,997	20,012 (4,002) [961] {480}	20,027 (4,005) [961] {481}	20,041 (4,008) [962] {481}
Lubbock	49,358	49,364	49,371	49,371	49,383 (9,877) [2,370] {1,185}	49,393 (9,879) [2,371] {1,185}	49,402 (9,880) [2,371] {1,186}
McLennan	27,563	27,581	27,592	27,592	27,619 (5,524) [1,326] {663}	27,645 (5,529) [1,327] {663}	27,670 (5,534) [1,328] {664}
Montgomery	54,623	54,643	54,624	54,624	54,678 (10,936) [2,625] {1,312}	54,728 (10,946) [2,627] {1,313}	54,775 (10,955) [2,629] {1,315}
Tarrant	260,993	261,124	261,163	261,201	261,300 (52,260) [12,542] {6,271}	261,397 (52,279) [12,547] {6,274}	261,484 (52,297) [12,551] {6,276}
Travis	83,878	83,910	83,910	83,910	83,961 (16,792) [4,030] {2,015}	84,007 (16,801) [4,032] {2,016}	84,054 (16,811) [4,035] {2,017}
Williamson	47,027	47,083	47,083	47,083	47,194 (9,439) [2,265] {1,133}	47,309 (9,462) [2,271] {1,135}	47,430 (9,486) [2,277] {1,138}

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.