IEM's AI Modeling: Short-term COVID-19 Projections
Date: 6/3/21

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 6/3/21 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
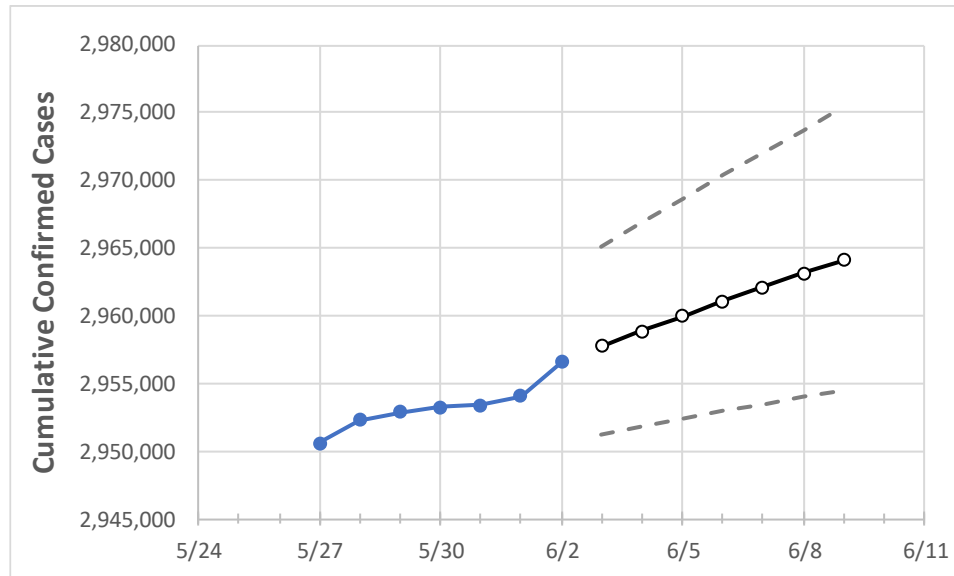
	Actual Confirmed Cases On:				Projected Cases For:						
	5/30	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7	6/8	6/9
Texas	2,953,235	2,953,409	2,954,084	2,956,576	2,957,724	2,958,846	2,959,997	2,961,080	2,962,106	2,963,138	2,964,110

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:						
	5/30	5/31	6/1	6/2	6/3	6/4	6/5	6/6	6/7	6/8	6/9
Bexar	222,898	222,898	222,898	222,898	223,041	223,181	223,318	223,454	223,581	223,715	223,846
Brazoria	38,088	38,097	38,106	38,115	38,130	38,144	38,158	38,172	38,186	38,199	38,211
Brazos	27,586	27,596	27,605	27,628	27,641	27,654	27,668	27,681	27,694	27,707	27,719
Collin	91,521	91,521	91,521	91,521	91,552	91,583	91,614	91,644	91,672	91,701	91,729
Dallas	303,245	303,263	303,280	303,533	303,609	303,682	303,750	303,818	303,888	303,955	304,016
Denton	76,091	76,113	76,135	76,203	76,237	76,269	76,302	76,332	76,361	76,390	76,418
El Paso	136,086	136,106	136,132	136,154	136,175	136,197	136,217	136,237	136,256	136,274	136,292
Ellis	23,040	23,049	23,058	23,067	23,076	23,084	23,092	23,099	23,107	23,115	23,122
Fort Bend	68,750	68,762	68,774	68,899	68,932	68,965	68,998	69,028	69,058	69,087	69,117
Galveston	40,369	40,384	40,415	40,446	40,470	40,493	40,515	40,536	40,556	40,575	40,594
Harris	400,293	400,364	400,436	400,507	400,704	400,900	401,090	401,279	401,467	401,648	401,822
Hidalgo	91,394	91,411	91,429	91,551	91,607	91,664	91,716	91,770	91,821	91,873	91,922
Johnson	19,959	19,967	19,974	19,982	19,991	19,999	20,008	20,017	20,026	20,035	20,044
Lubbock	49,326	49,333	49,340	49,347	49,354	49,361	49,368	49,375	49,381	49,388	49,394
McLennan	27,509	27,522	27,534	27,547	27,562	27,576	27,590	27,604	27,618	27,632	27,646
Montgomery	54,466	54,512	54,557	54,602	54,642	54,679	54,716	54,751	54,787	54,819	54,852
Tarrant	260,675	260,690	260,706	260,896	260,956	261,017	261,078	261,133	261,188	261,241	261,297
Travis	83,744	83,754	83,765	83,830	83,849	83,867	83,884	83,901	83,916	83,932	83,947
Williamson	46,690	46,690	46,690	46,690	46,704	46,719	46,732	46,745	46,757	46,769	46,780

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:		
	5/30	5/31	6/1	6/2	6/4	6/6	6/8
Bexar	222,898	222,898	222,898	222,898	223,181 (44,636) [10,713] {5,356}	223,454 (44,691) [10,726] {5,363}	223,715 (44,743) [10,738] {5,369}
Brazoria	38,088	38,097	38,106	38,115	38,144 (7,629) [1,831] {915}	38,172 (7,634) [1,832] {916}	38,199 (7,640) [1,834] {917}
Brazos	27,586	27,596	27,605	27,628	27,654 (5,531) [1,327] {664}	27,681 (5,536) [1,329] {664}	27,707 (5,541) [1,330] {665}
Collin	91,521	91,521	91,521	91,521	91,583 (18,317) [4,396] {2,198}	91,644 (18,329) [4,399] {2,199}	91,701 (18,340) [4,402] {2,201}
Dallas	303,245	303,263	303,280	303,533	303,682 (60,736) [14,577] {7,288}	303,818 (60,764) [14,583] {7,292}	303,955 (60,791) [14,590] {7,295}
Denton	76,091	76,113	76,135	76,203	76,269 (15,254) [3,661] {1,830}	76,332 (15,266) [3,664] {1,832}	76,390 (15,278) [3,667] {1,833}
El Paso	136,086	136,106	136,132	136,154	136,197 (27,239) [6,537] {3,269}	136,237 (27,247) [6,539] {3,270}	136,274 (27,255) [6,541] {3,271}
Ellis	23,040	23,049	23,058	23,067	23,084 (4,617) [1,108] {554}	23,099 (4,620) [1,109] {554}	23,115 (4,623) [1,110] {555}
Fort Bend	68,750	68,762	68,774	68,899	68,965 (13,793) [3,310] {1,655}	69,028 (13,806) [3,313] {1,657}	69,087 (13,817) [3,316] {1,658}
Galveston	40,369	40,384	40,415	40,446	40,493 (8,099) [1,944] {972}	40,536 (8,107) [1,946] {973}	40,575 (8,115) [1,948] {974}
Harris	400,293	400,364	400,436	400,507	400,900 (80,180) [19,243] {9,622}	401,279 (80,256) [19,261] {9,631}	401,648 (80,330) [19,279] {9,640}
Hidalgo	91,394	91,411	91,429	91,551	91,664 (18,333) [4,400] {2,200}	91,770 (18,354) [4,405] {2,202}	91,873 (18,375) [4,410] {2,205}
Johnson	19,959	19,967	19,974	19,982	19,999 (4,000) [960] {480}	20,017 (4,003) [961] {480}	20,035 (4,007) [962] {481}
Lubbock	49,326	49,333	49,340	49,347	49,361 (9,872) [2,369] {1,185}	49,375 (9,875) [2,370] {1,185}	49,388 (9,878) [2,371] {1,185}
McLennan	27,509	27,522	27,534	27,547	27,576 (5,515) [1,324] {662}	27,604 (5,521) [1,325] {662}	27,632 (5,526) [1,326] {663}
Montgomery	54,466	54,512	54,557	54,602	54,679 (10,936) [2,625] {1,312}	54,751 (10,950) [2,628] {1,314}	54,819 (10,964) [2,631] {1,316}
Tarrant	260,675	260,690	260,706	260,896	261,017 (52,203) [12,529] {6,264}	261,133 (52,227) [12,534] {6,267}	261,241 (52,248) [12,540] {6,270}
Travis	83,744	83,754	83,765	83,830	83,867 (16,773) [4,026] {2,013}	83,901 (16,780) [4,027] {2,014}	83,932 (16,786) [4,029] {2,014}
Williamson	46,690	46,690	46,690	46,690	46,719 (9,344) [2,243] {1,121}	46,745 (9,349) [2,244] {1,122}	46,769 (9,354) [2,245] {1,122}

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.