IEM's AI Modeling: Short-term COVID-19 Projections
Date: 5/25/21

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 5/25/21 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
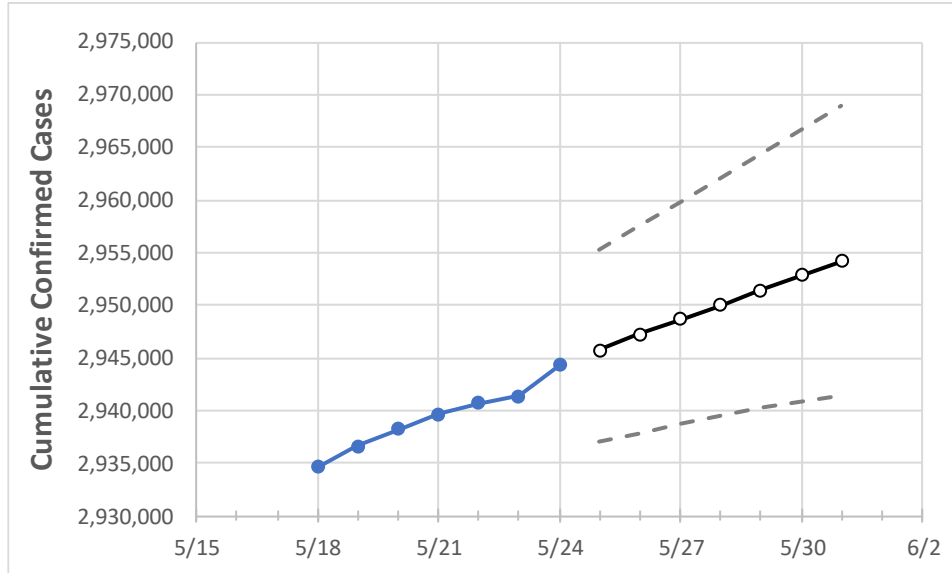
	Actual Confirmed Cases On:				Projected Cases For:						
	5/21	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31
Texas	2,939,697	2,940,679	2,941,389	2,944,265	2,945,762	2,947,209	2,948,644	2,950,036	2,951,406	2,952,815	2,954,212

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:						
	5/21	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30	5/31
Bexar	221,664	221,919	222,174	222,429	222,586	222,745	222,903	223,055	223,209	223,364	223,508
Brazoria	37,970	37,962	37,962	37,962	37,992	38,023	38,054	38,084	38,115	38,143	38,172
Brazos	26,821	26,828	27,155	27,481	27,589	27,705	27,828	27,961	28,100	28,251	28,403
Collin	91,221	91,277	91,337	91,378	91,424	91,465	91,507	91,549	91,590	91,633	91,672
Dallas	302,368	302,425	302,450	302,651	302,762	302,868	302,976	303,077	303,175	303,269	303,362
Denton	75,693	75,732	75,772	75,811	75,857	75,902	75,944	75,988	76,033	76,076	76,116
El Paso	135,804	135,843	135,880	135,883	135,937	135,992	136,043	136,093	136,141	136,189	136,234
Ellis	22,947	22,963	22,963	22,963	22,975	22,987	23,000	23,012	23,024	23,036	23,047
Fort Bend	68,394	68,417	68,439	68,462	68,507	68,551	68,594	68,634	68,671	68,710	68,749
Galveston	40,073	40,123	40,156	40,156	40,202	40,247	40,293	40,338	40,382	40,427	40,471
Harris	397,751	398,013	398,276	398,573	398,754	398,931	399,103	399,270	399,435	399,595	399,756
Hidalgo	90,738	90,738	90,738	90,738	90,849	90,963	91,072	91,184	91,293	91,407	91,523
Johnson	19,887	19,891	19,891	19,891	19,930	19,970	20,012	20,058	20,105	20,156	20,208
Lubbock	49,238	49,253	49,253	49,253	49,269	49,284	49,300	49,316	49,332	49,347	49,363
McLennan	27,356	27,356	27,356	27,356	27,370	27,384	27,398	27,411	27,425	27,439	27,452
Montgomery	54,013	54,071	54,130	54,188	54,244	54,298	54,350	54,402	54,451	54,500	54,549
Tarrant	259,949	260,020	260,090	260,264	260,372	260,484	260,588	260,692	260,800	260,899	260,999
Travis	83,524	83,524	83,524	83,524	83,557	83,590	83,622	83,653	83,683	83,712	83,740
Williamson	46,528	46,552	46,576	46,600	46,627	46,655	46,680	46,705	46,729	46,751	46,774

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](link)) 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:		
	5/21	5/22	5/23	5/24	5/26	5/28	5/30
Bexar	221,664	221,919	222,174	222,429	222,745 (44,549) [10,692] {5,346}	223,055 (44,611) [10,707] {5,353}	223,364 (44,673) [10,721] {5,361}
Brazoria	37,970	37,962	37,962	37,962	38,023 (7,605) [1,825] {913}	38,084 (7,617) [1,828] {914}	38,143 (7,629) [1,831] {915}
Brazos	26,821	26,828	27,155	27,481	27,705 (5,541) [1,330] {665}	27,961 (5,592) [1,342] {671}	28,251 (5,650) [1,356] {678}
Collin	91,221	91,277	91,337	91,378	91,465 (18,293) [4,390] {2,195}	91,549 (18,310) [4,394] {2,197}	91,633 (18,327) [4,398] {2,199}
Dallas	302,368	302,425	302,450	302,651	302,868 (60,574) [14,538] {7,269}	303,077 (60,615) [14,548] {7,274}	303,269 (60,654) [14,557] {7,278}
Denton	75,693	75,732	75,772	75,811	75,902 (15,180) [3,643] {1,822}	75,988 (15,198) [3,647] {1,824}	76,076 (15,215) [3,652] {1,826}
El Paso	135,804	135,843	135,880	135,883	135,992 (27,198) [6,528] {3,264}	136,093 (27,219) [6,532] {3,266}	136,189 (27,238) [6,537] {3,269}
Ellis	22,947	22,963	22,963	22,963	22,987 (4,597) [1,103] {552}	23,012 (4,602) [1,105] {552}	23,036 (4,607) [1,106] {553}
Fort Bend	68,394	68,417	68,439	68,462	68,551 (13,710) [3,290] {1,645}	68,634 (13,727) [3,294] {1,647}	68,710 (13,742) [3,298] {1,649}
Galveston	40,073	40,123	40,156	40,156	40,247 (8,049) [1,932] {966}	40,338 (8,068) [1,936] {968}	40,427 (8,085) [1,940] {970}
Harris	397,751	398,013	398,276	398,573	398,931 (79,786) [19,149] {9,574}	399,270 (79,854) [19,165] {9,582}	399,595 (79,919) [19,181] {9,590}
Hidalgo	90,738	90,738	90,738	90,738	90,963 (18,193) [4,366] {2,183}	91,184 (18,237) [4,377] {2,188}	91,407 (18,281) [4,388] {2,194}
Johnson	19,887	19,891	19,891	19,891	19,970 (3,994) [959] {479}	20,058 (4,012) [963] {481}	20,156 (4,031) [967] {484}
Lubbock	49,238	49,253	49,253	49,253	49,284 (9,857) [2,366] {1,183}	49,316 (9,863) [2,367] {1,184}	49,347 (9,869) [2,369] {1,184}
McLennan	27,356	27,356	27,356	27,356	27,384 (5,477) [1,314] {657}	27,411 (5,482) [1,316] {658}	27,439 (5,488) [1,317] {659}
Montgomery	54,013	54,071	54,130	54,188	54,298 (10,860) [2,606] {1,303}	54,402 (10,880) [2,611] {1,306}	54,500 (10,900) [2,616] {1,308}
Tarrant	259,949	260,020	260,090	260,264	260,484 (52,097) [12,503] {6,252}	260,692 (52,138) [12,513] {6,257}	260,899 (52,180) [12,523] {6,262}
Travis	83,524	83,524	83,524	83,524	83,590 (16,718) [4,012] {2,006}	83,653 (16,731) [4,015] {2,008}	83,712 (16,742) [4,018] {2,009}
Williamson	46,528	46,552	46,576	46,600	46,655 (9,331) [2,239] {1,120}	46,705 (9,341) [2,242] {1,121}	46,751 (9,350) [2,244] {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.