IEM's AI Modeling: Short-term COVID-19 Projections
Date: 1/19/21

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 1/19/21 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
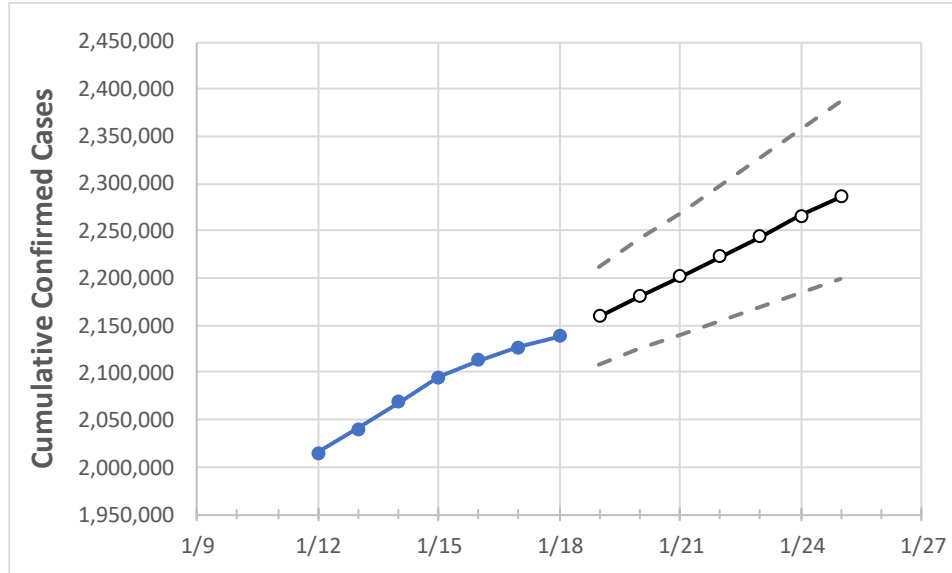
	Actual Confirmed Cases On:				Projected Cases For:						
	1/15	1/16	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25
Texas	2,094,921	2,112,662	2,127,111	2,138,190	2,159,298	2,180,488	2,201,587	2,222,909	2,244,421	2,266,002	2,286,693

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:						
	1/15	1/16	1/17	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25
Bexar	143,503	146,343	148,555	149,836	152,082	154,363	156,688	159,073	161,485	163,961	166,433
Brazoria	25,440	25,627	25,789	25,906	26,163	26,413	26,657	26,916	27,165	27,421	27,665
Brazos	16,634	16,749	16,860	16,980	17,148	17,317	17,489	17,662	17,836	18,008	18,191
Collin	61,803	62,571	63,239	63,842	64,711	65,586	66,449	67,336	68,208	69,101	69,959
Dallas	230,439	233,248	234,625	234,625	237,234	239,810	242,351	244,956	247,587	250,227	252,890
Denton	45,816	46,272	46,272	46,272	46,812	47,354	47,917	48,493	49,056	49,641	50,224
El Paso	106,312	106,495	106,677	107,191	107,709	108,246	108,786	109,319	109,875	110,442	111,015
Ellis	16,269	16,403	16,403	16,403	16,614	16,823	17,032	17,238	17,448	17,659	17,866
Fort Bend	43,662	43,797	43,932	44,067	44,574	45,074	45,632	46,201	46,745	47,325	47,896
Galveston	26,407	26,643	26,898	26,898	27,416	27,958	28,526	29,124	29,750	30,413	31,104
Harris	278,312	281,422	284,917	286,356	289,835	293,264	296,854	300,465	304,347	308,314	312,372
Hidalgo	57,337	57,337	57,337	57,337	57,886	58,468	59,063	59,673	60,333	61,014	61,698
Johnson	14,259	14,435	14,435	14,435	14,705	15,004	15,295	15,591	15,895	16,211	16,520
Lubbock	45,067	45,203	45,308	45,490	45,646	45,792	45,933	46,078	46,214	46,346	46,481
McLennan	21,598	21,809	21,894	21,894	22,093	22,296	22,502	22,704	22,905	23,112	23,317
Montgomery	33,006	33,006	33,006	33,006	33,505	34,015	34,530	35,043	35,578	36,115	36,664
Tarrant	187,863	189,375	190,886	195,518	198,194	200,894	203,627	206,225	209,002	211,738	214,471
Travis	60,084	60,379	60,782	61,468	62,142	62,809	63,501	64,194	64,890	65,585	66,295
Williamson	29,796	29,796	29,796	29,796	30,352	30,915	31,493	32,079	32,678	33,312	33,930

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:		
	1/15	1/16	1/17	1/18	1/20	1/22	1/24
Bexar	143,503	146,343	148,555	149,836	154,363 (30,873) [7,409] {3,705}	159,073 (31,815) [7,636] {3,818}	163,961 (32,792) [7,870] {3,935}
Brazoria	25,440	25,627	25,789	25,906	26,413 (5,283) [1,268] {634}	26,916 (5,383) [1,292] {646}	27,421 (5,484) [1,316] {658}
Brazos	16,634	16,749	16,860	16,980	17,317 (3,463) [831] {416}	17,662 (3,532) [848] {424}	18,008 (3,602) [864] {432}
Collin	61,803	62,571	63,239	63,842	65,586 (13,117) [3,148] {1,574}	67,336 (13,467) [3,232] {1,616}	69,101 (13,820) [3,317] {1,658}
Dallas	230,439	233,248	234,625	234,625	239,810 (47,962) [11,511] {5,755}	244,956 (48,991) [11,758] {5,879}	250,227 (50,045) [12,011] {6,005}
Denton	45,816	46,272	46,272	46,272	47,354 (9,471) [2,273] {1,137}	48,493 (9,699) [2,328] {1,164}	49,641 (9,928) [2,383] {1,191}
El Paso	106,312	106,495	106,677	107,191	108,246 (21,649) [5,196] {2,598}	109,319 (21,864) [5,247] {2,624}	110,442 (22,088) [5,301] {2,651}
Ellis	16,269	16,403	16,403	16,403	16,823 (3,365) [808] {404}	17,238 (3,448) [827] {414}	17,659 (3,532) [848] {424}
Fort Bend	43,662	43,797	43,932	44,067	45,074 (9,015) [2,164] {1,082}	46,201 (9,240) [2,218] {1,109}	47,325 (9,465) [2,272] {1,136}
Galveston	26,407	26,643	26,898	26,898	27,958 (5,592) [1,342] {671}	29,124 (5,825) [1,398] {699}	30,413 (6,083) [1,460] {730}
Harris	278,312	281,422	284,917	286,356	293,264 (58,653) [14,077] {7,038}	300,465 (60,093) [14,422] {7,211}	308,314 (61,663) [14,799] {7,400}
Hidalgo	57,337	57,337	57,337	57,337	58,468 (11,694) [2,806] {1,403}	59,673 (11,935) [2,864] {1,432}	61,014 (12,203) [2,929] {1,464}
Johnson	14,259	14,435	14,435	14,435	15,004 (3,001) [720] {360}	15,591 (3,118) [748] {374}	16,211 (3,242) [778] {389}
Lubbock	45,067	45,203	45,308	45,490	45,792 (9,158) [2,198] {1,099}	46,078 (9,216) [2,212] {1,106}	46,346 (9,269) [2,225] {1,112}
McLennan	21,598	21,809	21,894	21,894	22,296 (4,459) [1,070] {535}	22,704 (4,541) [1,090] {545}	23,112 (4,622) [1,109] {555}
Montgomery	33,006	33,006	33,006	33,006	34,015 (6,803) [1,633] {816}	35,043 (7,009) [1,682] {841}	36,115 (7,223) [1,734] {867}
Tarrant	187,863	189,375	190,886	195,518	200,894 (40,179) [9,643] {4,821}	206,225 (41,245) [9,899] {4,949}	211,738 (42,348) [10,163] {5,082}
Travis	60,084	60,379	60,782	61,468	62,809 (12,562) [3,015] {1,507}	64,194 (12,839) [3,081] {1,541}	65,585 (13,117) [3,148] {1,574}
Williamson	29,796	29,796	29,796	29,796	30,915 (6,183) [1,484] {742}	32,079 (6,416) [1,540] {770}	33,312 (6,662) [1,599] {799}

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.