IEM's AI Modeling: Short-term COVID-19 Projections
Date: 12/30/20

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 not 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 12/30/20 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
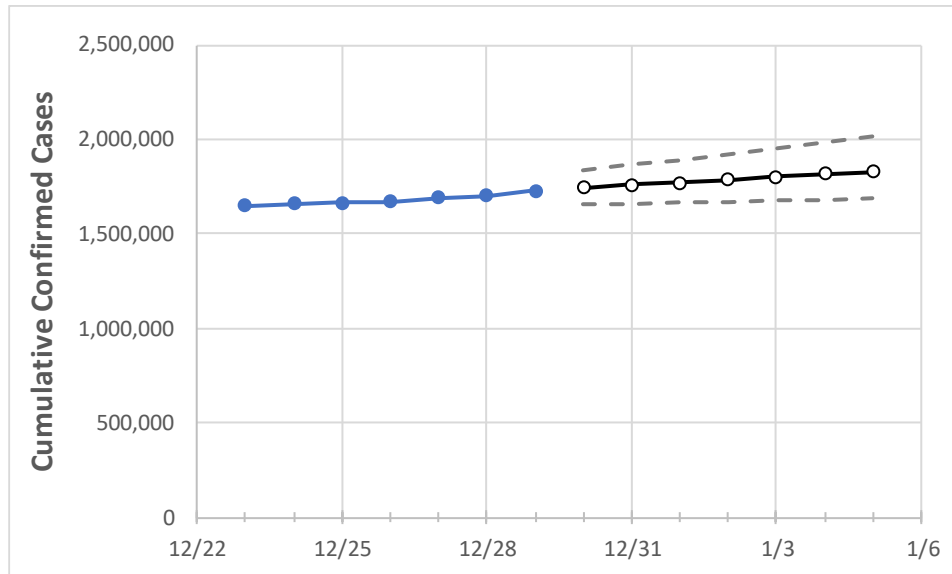
	Actual Confirmed Cases On:				Projected Cases For:						
	12/26	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3	1/4	1/5
Texas	1,668,138	1,690,986	1,700,549	1,730,084	1,744,324	1,758,923	1,773,046	1,786,999	1,801,247	1,815,726	1,830,145

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 20%, and are often within 10%, of actual confirmed cases.

Texas Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	12/26	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3	1/4	1/5
Bexar	110,862	112,218	112,261	114,362	115,795	117,229	118,733	120,239	121,787	123,378	124,964
Brazoria	20,214	20,250	20,664	20,735	20,940	21,147	21,349	21,555	21,761	21,969	22,169
Brazos	13,794	13,828	13,950	14,077	14,160	14,242	14,329	14,410	14,492	14,570	14,650
Collin	45,092	45,600	46,018	47,197	47,985	48,797	49,607	50,435	51,277	52,146	53,029
Dallas	180,806	186,880	188,123	189,252	191,021	192,795	194,660	196,463	198,306	200,090	201,858
Denton	36,813	37,038	37,262	38,094	38,410	38,725	39,020	39,298	39,582	39,856	40,110
El Paso	97,053	97,178	97,409	97,710	97,956	98,198	98,435	98,662	98,887	99,106	99,321
Ellis	12,140	12,230	12,448	12,665	12,840	13,017	13,198	13,379	13,561	13,743	13,928
Fort Bend	34,188	34,290	34,391	34,493	34,736	34,959	35,165	35,388	35,608	35,803	36,026
Galveston	20,372	20,655	20,765	20,874	21,167	21,468	21,782	22,101	22,443	22,786	23,153
Harris	225,443	231,707	233,330	234,736	236,656	238,593	240,603	242,620	244,692	246,747	248,990
Hidalgo	49,880	49,956	50,032	50,361	50,500	50,663	50,813	50,947	51,077	51,217	51,348
Johnson	10,163	10,208	10,437	10,665	10,806	10,948	11,090	11,230	11,370	11,508	11,655
Lubbock	40,691	40,929	41,034	41,205	41,431	41,656	41,871	42,086	42,287	42,493	42,686
McLennan	18,025	18,134	18,242	18,350	18,470	18,589	18,706	18,821	18,938	19,049	19,165
Montgomery	25,373	25,708	26,044	26,379	26,767	27,158	27,565	28,001	28,434	28,881	29,346
Tarrant	136,902	137,456	138,010	144,001	145,562	147,130	148,752	150,362	151,969	153,637	155,273
Travis	48,208	48,424	48,951	49,648	50,139	50,639	51,135	51,643	52,152	52,669	53,205
Williamson	21,167	21,348	21,529	21,710	21,975	22,236	22,502	22,764	23,025	23,293	23,554

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:		
	12/26	12/27	12/28	12/29	12/31	1/2	1/4
Bexar	110,862	112,218	112,261	114,362	117,229 (23,446) [5,627] {2,813}	120,239 (24,048) [5,771] {2,886}	123,378 (24,676) [5,922] {2,961}
Brazoria	20,214	20,250	20,664	20,735	21,147 (4,229) [1,015] {508}	21,555 (4,311) [1,035] {517}	21,969 (4,394) [1,054] {527}
Brazos	13,794	13,828	13,950	14,077	14,242 (2,848) [684] {342}	14,410 (2,882) [692] {346}	14,570 (2,914) [699] {350}
Collin	45,092	45,600	46,018	47,197	48,797 (9,759) [2,342] {1,171}	50,435 (10,087) [2,421] {1,210}	52,146 (10,429) [2,503] {1,251}
Dallas	180,806	186,880	188,123	189,252	192,795 (38,559) [9,254] {4,627}	196,463 (39,293) [9,430] {4,715}	200,090 (40,018) [9,604] {4,802}
Denton	36,813	37,038	37,262	38,094	38,725 (7,745) [1,859] {929}	39,298 (7,860) [1,886] {943}	39,856 (7,971) [1,913] {957}
El Paso	97,053	97,178	97,409	97,710	98,198 (19,640) [4,714] {2,357}	98,662 (19,732) [4,736] {2,368}	99,106 (19,821) [4,757] {2,379}
Ellis	12,140	12,230	12,448	12,665	13,017 (2,603) [625] {312}	13,379 (2,676) [642] {321}	13,743 (2,749) [660] {330}
Fort Bend	34,188	34,290	34,391	34,493	34,959 (6,992) [1,678] {839}	35,388 (7,078) [1,699] {849}	35,803 (7,161) [1,719] {859}
Galveston	20,372	20,655	20,765	20,874	21,468 (4,294) [1,030] {515}	22,101 (4,420) [1,061] {530}	22,786 (4,557) [1,094] {547}
Harris	225,443	231,707	233,330	234,736	238,593 (47,719) [11,452] {5,726}	242,620 (48,524) [11,646] {5,823}	246,747 (49,349) [11,844] {5,922}
Hidalgo	49,880	49,956	50,032	50,361	50,663 (10,133) [2,432] {1,216}	50,947 (10,189) [2,445] {1,223}	51,217 (10,243) [2,458] {1,229}
Johnson	10,163	10,208	10,437	10,665	10,948 (2,190) [525] {263}	11,230 (2,246) [539] {270}	11,508 (2,302) [552] {276}
Lubbock	40,691	40,929	41,034	41,205	41,656 (8,331) [1,999] {1,000}	42,086 (8,417) [2,020] {1,010}	42,493 (8,499) [2,040] {1,020}
McLennan	18,025	18,134	18,242	18,350	18,589 (3,718) [892] {446}	18,821 (3,764) [903] {452}	19,049 (3,810) [914] {457}
Montgomery	25,373	25,708	26,044	26,379	27,158 (5,432) [1,304] {652}	28,001 (5,600) [1,344] {672}	28,881 (5,776) [1,386] {693}
Tarrant	136,902	137,456	138,010	144,001	147,130 (29,426) [7,062] {3,531}	150,362 (30,072) [7,217] {3,609}	153,637 (30,727) [7,375] {3,687}
Travis	48,208	48,424	48,951	49,648	50,639 (10,128) [2,431] {1,215}	51,643 (10,329) [2,479] {1,239}	52,669 (10,534) [2,528] {1,264}
Williamson	21,167	21,348	21,529	21,710	22,236 (4,447) [1,067] {534}	22,764 (4,553) [1,093] {546}	23,293 (4,659) [1,118] {559}

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.