IEM's AI Modeling: Short-term COVID-19 Projections
Date: 12/29/21

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 12/29/21 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
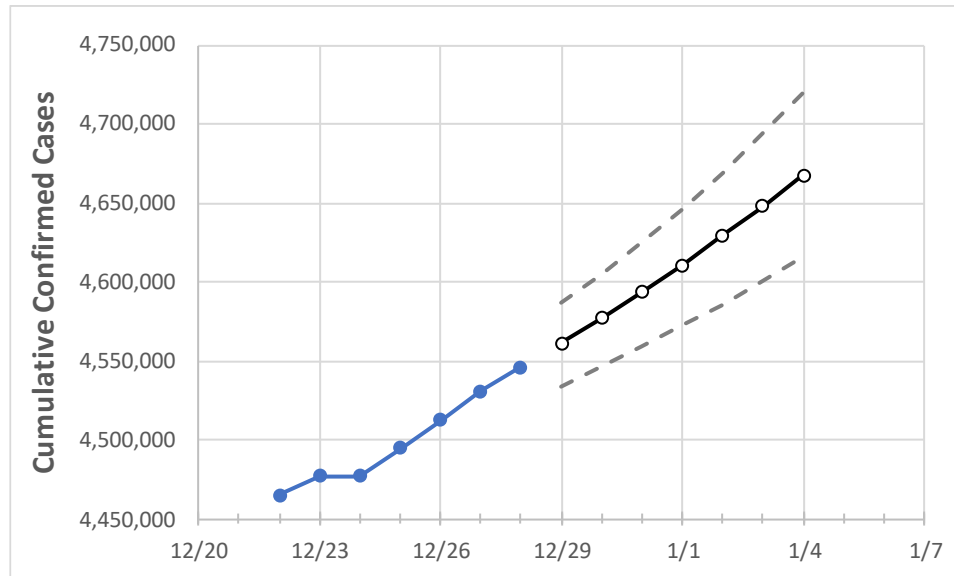
	Actual Confirmed Cases On:				Projected Cases For:						
	12/25	12/26	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3	1/4
Texas	4,494,795	4,512,681	4,530,566	4,545,945	4,561,157	4,576,970	4,593,449	4,610,757	4,629,459	4,648,051	4,667,747

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:						
	12/25	12/26	12/27	12/28	12/29	12/30	12/31	1/1	1/2	1/3	1/4
Bexar	336,134	336,889	337,645	338,666	339,666	340,771	341,977	343,280	344,687	346,186	347,802
Brazoria	64,597	65,029	65,461	65,767	66,258	66,788	67,350	67,955	68,601	69,302	70,054
Brazos	40,178	40,335	40,491	40,558	40,717	40,891	41,077	41,281	41,500	41,739	41,988
Collin	138,379	138,840	139,300	139,904	140,420	140,969	141,547	142,160	142,800	143,485	144,197
Dallas	429,760	430,936	432,113	433,707	435,093	436,548	438,097	439,733	441,486	443,336	445,271
Denton	114,903	115,134	115,364	115,923	116,187	116,454	116,729	117,011	117,310	117,612	117,918
El Paso	166,514	166,650	166,785	167,139	167,294	167,448	167,600	167,745	167,903	168,038	168,190
Ellis	35,074	35,153	35,231	35,354	35,450	35,551	35,655	35,766	35,882	36,007	36,134
Fort Bend	110,327	111,164	112,000	113,077	114,248	115,499	116,875	118,353	119,976	121,734	123,636
Galveston	67,985	68,352	68,718	68,896	69,281	69,684	70,123	70,592	71,097	71,649	72,232
Harris	627,427	632,229	637,031	640,277	646,274	652,767	659,743	667,308	675,653	684,520	694,227
Hidalgo	122,552	122,609	122,667	122,725	122,808	122,881	122,965	123,038	123,116	123,191	123,260
Johnson	30,273	30,319	30,366	30,462	30,516	30,573	30,629	30,686	30,745	30,807	30,866
Lubbock	70,534	70,651	70,768	70,843	70,962	71,079	71,193	71,311	71,433	71,553	71,668
McLennan	44,094	44,166	44,237	44,324	44,398	44,477	44,555	44,638	44,726	44,815	44,907
Montgomery	93,239	93,633	94,027	94,407	94,870	95,362	95,888	96,442	97,044	97,683	98,364
Tarrant	380,708	380,783	380,858	381,795	382,199	382,573	382,951	383,338	383,722	384,131	384,553
Travis	129,673	130,554	131,434	132,230	133,246	134,336	135,531	136,813	138,220	139,727	141,390
Williamson	82,216	82,531	82,845	83,183	83,538	83,920	84,321	84,747	85,192	85,674	86,168

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:		
	12/25	12/26	12/27	12/28	12/30	1/1	1/3
Bexar	336,134	336,889	337,645	338,666	340,771 (68,154) [16,357] {8,179}	343,280 (68,656) [16,477] {8,239}	346,186 (69,237) [16,617] {8,308}
Brazoria	64,597	65,029	65,461	65,767	66,788 (13,358) [3,206] {1,603}	67,955 (13,591) [3,262] {1,631}	69,302 (13,860) [3,327] {1,663}
Brazos	40,178	40,335	40,491	40,558	40,891 (8,178) [1,963] {981}	41,281 (8,256) [1,982] {991}	41,739 (8,348) [2,003] {1,002}
Collin	138,379	138,840	139,300	139,904	140,969 (28,194) [6,767] {3,383}	142,160 (28,432) [6,824] {3,412}	143,485 (28,697) [6,887] {3,444}
Dallas	429,760	430,936	432,113	433,707	436,548 (87,310) [20,954] {10,477}	439,733 (87,947) [21,107] {10,554}	443,336 (88,667) [21,280] {10,640}
Denton	114,903	115,134	115,364	115,923	116,454 (23,291) [5,590] {2,795}	117,011 (23,402) [5,617] {2,808}	117,612 (23,522) [5,645] {2,823}
El Paso	166,514	166,650	166,785	167,139	167,448 (33,490) [8,037] {4,019}	167,745 (33,549) [8,052] {4,026}	168,038 (33,608) [8,066] {4,033}
Ellis	35,074	35,153	35,231	35,354	35,551 (7,110) [1,706] {853}	35,766 (7,153) [1,717] {858}	36,007 (7,201) [1,728] {864}
Fort Bend	110,327	111,164	112,000	113,077	115,499 (23,100) [5,544] {2,772}	118,353 (23,671) [5,681] {2,840}	121,734 (24,347) [5,843] {2,922}
Galveston	67,985	68,352	68,718	68,896	69,684 (13,937) [3,345] {1,672}	70,592 (14,118) [3,388] {1,694}	71,649 (14,330) [3,439] {1,720}
Harris	627,427	632,229	637,031	640,277	652,767 (130,553) [31,333] {15,666}	667,308 (133,462) [32,031] {16,015}	684,520 (136,904) [32,857] {16,428}
Hidalgo	122,552	122,609	122,667	122,725	122,881 (24,576) [5,898] {2,949}	123,038 (24,608) [5,906] {2,953}	123,191 (24,638) [5,913] {2,957}
Johnson	30,273	30,319	30,366	30,462	30,573 (6,115) [1,468] {734}	30,686 (6,137) [1,473] {736}	30,807 (6,161) [1,479] {739}
Lubbock	70,534	70,651	70,768	70,843	71,079 (14,216) [3,412] {1,706}	71,311 (14,262) [3,423] {1,711}	71,553 (14,311) [3,435] {1,717}
McLennan	44,094	44,166	44,237	44,324	44,477 (8,895) [2,135] {1,067}	44,638 (8,928) [2,143] {1,071}	44,815 (8,963) [2,151] {1,076}
Montgomery	93,239	93,633	94,027	94,407	95,362 (19,072) [4,577] {2,289}	96,442 (19,288) [4,629] {2,315}	97,683 (19,537) [4,689] {2,344}
Tarrant	380,708	380,783	380,858	381,795	382,573 (76,515) [18,364] {9,182}	383,338 (76,668) [18,400] {9,200}	384,131 (76,826) [18,438] {9,219}
Travis	129,673	130,554	131,434	132,230	134,336 (26,867) [6,448] {3,224}	136,813 (27,363) [6,567] {3,284}	139,727 (27,945) [6,707] {3,353}
Williamson	82,216	82,531	82,845	83,183	83,920 (16,784) [4,028] {2,014}	84,747 (16,949) [4,068] {2,034}	85,674 (17,135) [4,112] {2,056}

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.