IEM's AI Modeling: Short-term COVID-19 Projections
Date: 10/22/21

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 10/22/21 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
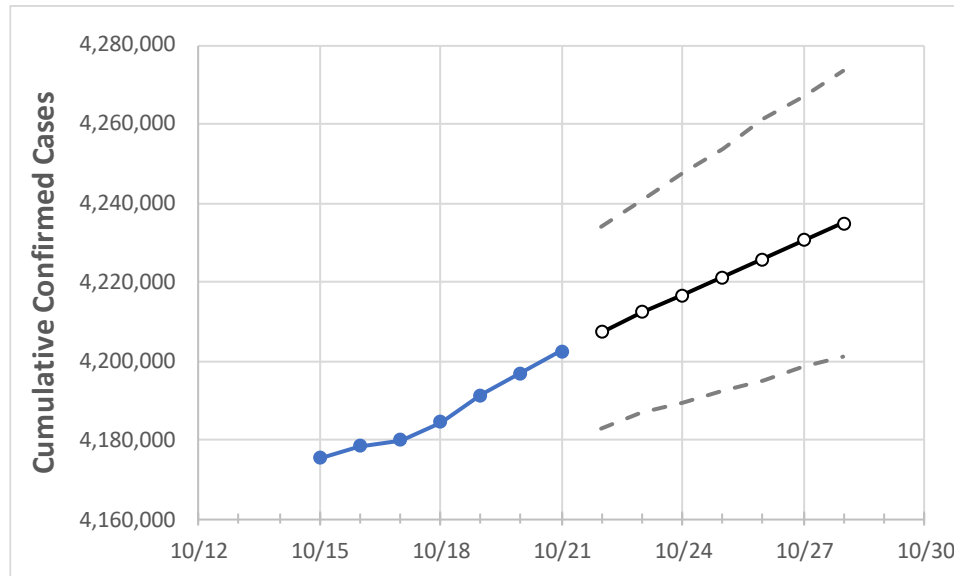
	Actual Confirmed Cases On:				Projected Cases For:						
	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26	10/27	10/28
Texas	4,184,467	4,191,397	4,196,761	4,202,418	4,207,365	4,212,284	4,216,741	4,221,258	4,225,709	4,230,538	4,234,857

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:						
	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26	10/27	10/28
Bexar	318,126	318,387	318,735	318,949	319,248	319,545	319,825	320,111	320,391	320,653	320,926
Brazoria	59,138	59,168	59,168	59,168	59,254	59,352	59,442	59,526	59,620	59,724	59,817
Brazos	38,382	38,415	38,445	38,455	38,483	38,506	38,525	38,548	38,567	38,586	38,605
Collin	127,723	127,923	128,037	128,184	128,331	128,470	128,608	128,746	128,877	129,012	129,140
Dallas	399,401	400,449	401,005	401,467	401,932	402,424	402,899	403,362	403,823	404,293	404,733
Denton	105,437	105,739	106,088	106,351	106,580	106,795	107,004	107,234	107,454	107,667	107,879
El Paso	147,301	147,424	147,547	147,728	147,863	148,002	148,142	148,279	148,419	148,563	148,703
Ellis	32,890	32,945	33,006	33,106	33,173	33,240	33,305	33,370	33,434	33,500	33,563
Fort Bend	98,432	98,817	98,905	99,392	99,562	99,721	99,866	100,025	100,187	100,345	100,481
Galveston	63,599	63,665	63,709	63,752	63,809	63,867	63,927	63,983	64,037	64,090	64,143
Harris	570,129	570,517	570,901	571,827	572,403	572,892	573,436	573,927	574,397	574,971	575,419
Hidalgo	116,645	116,762	116,938	117,053	117,122	117,195	117,258	117,324	117,389	117,453	117,523
Johnson	27,829	27,870	27,937	28,085	28,164	28,242	28,319	28,395	28,478	28,555	28,636
Lubbock	64,976	65,031	65,109	65,182	65,242	65,302	65,360	65,420	65,477	65,536	65,592
McLennan	41,813	41,849	41,883	41,948	41,991	42,033	42,074	42,115	42,155	42,193	42,230
Montgomery	87,070	87,132	87,201	87,269	87,343	87,413	87,479	87,544	87,609	87,673	87,734
Tarrant	357,466	357,794	358,283	358,735	359,201	359,659	360,107	360,542	360,966	361,401	361,809
Travis	118,391	118,564	118,671	118,822	118,962	119,093	119,231	119,364	119,494	119,630	119,759
Williamson	75,344	75,422	75,561	75,682	75,805	75,918	76,029	76,142	76,256	76,365	76,469

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:		
	10/18	10/19	10/20	10/21	10/23	10/25	10/27
Bexar	318,126	318,387	318,735	318,949	319,545 (63,909) [15,338] {7,669}	320,111 (64,022) [15,365] {7,683}	320,653 (64,131) [15,391] {7,696}
Brazoria	59,138	59,168	59,168	59,168	59,352 (11,870) [2,849] {1,424}	59,526 (11,905) [2,857] {1,429}	59,724 (11,945) [2,867] {1,433}
Brazos	38,382	38,415	38,445	38,455	38,506 (7,701) [1,848] {924}	38,548 (7,710) [1,850] {925}	38,586 (7,717) [1,852] {926}
Collin	127,723	127,923	128,037	128,184	128,470 (25,694) [6,167] {3,083}	128,746 (25,749) [6,180] {3,090}	129,012 (25,802) [6,193] {3,096}
Dallas	399,401	400,449	401,005	401,467	402,424 (80,485) [19,316] {9,658}	403,362 (80,672) [19,361] {9,681}	404,293 (80,859) [19,406] {9,703}
Denton	105,437	105,739	106,088	106,351	106,795 (21,359) [5,126] {2,563}	107,234 (21,447) [5,147] {2,574}	107,667 (21,533) [5,168] {2,584}
El Paso	147,301	147,424	147,547	147,728	148,002 (29,600) [7,104] {3,552}	148,279 (29,656) [7,117] {3,559}	148,563 (29,713) [7,131] {3,566}
Ellis	32,890	32,945	33,006	33,106	33,240 (6,648) [1,596] {798}	33,370 (6,674) [1,602] {801}	33,500 (6,700) [1,608] {804}
Fort Bend	98,432	98,817	98,905	99,392	99,721 (19,944) [4,787] {2,393}	100,025 (20,005) [4,801] {2,401}	100,345 (20,069) [4,817] {2,408}
Galveston	63,599	63,665	63,709	63,752	63,867 (12,773) [3,066] {1,533}	63,983 (12,797) [3,071] {1,536}	64,090 (12,818) [3,076] {1,538}
Harris	570,129	570,517	570,901	571,827	572,892 (114,578) [27,499] {13,749}	573,927 (114,785) [27,549] {13,774}	574,971 (114,994) [27,599] {13,799}
Hidalgo	116,645	116,762	116,938	117,053	117,195 (23,439) [5,625] {2,813}	117,324 (23,465) [5,632] {2,816}	117,453 (23,491) [5,638] {2,819}
Johnson	27,829	27,870	27,937	28,085	28,242 (5,648) [1,356] {678}	28,395 (5,679) [1,363] {681}	28,555 (5,711) [1,371] {685}
Lubbock	64,976	65,031	65,109	65,182	65,302 (13,060) [3,134] {1,567}	65,420 (13,084) [3,140] {1,570}	65,536 (13,107) [3,146] {1,573}
McLennan	41,813	41,849	41,883	41,948	42,033 (8,407) [2,018] {1,009}	42,115 (8,423) [2,022] {1,011}	42,193 (8,439) [2,025] {1,013}
Montgomery	87,070	87,132	87,201	87,269	87,413 (17,483) [4,196] {2,098}	87,544 (17,509) [4,202] {2,101}	87,673 (17,535) [4,208] {2,104}
Tarrant	357,466	357,794	358,283	358,735	359,659 (71,932) [17,264] {8,632}	360,542 (72,108) [17,306] {8,653}	361,401 (72,280) [17,347] {8,674}
Travis	118,391	118,564	118,671	118,822	119,093 (23,819) [5,716] {2,858}	119,364 (23,873) [5,729] {2,865}	119,630 (23,926) [5,742] {2,871}
Williamson	75,344	75,422	75,561	75,682	75,918 (15,184) [3,644] {1,822}	76,142 (15,228) [3,655] {1,827}	76,365 (15,273) [3,666] {1,833}

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.