IEM's AI Modeling: Short-term COVID-19 Projections
Date: 11/18/20

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 <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 11/18/20 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
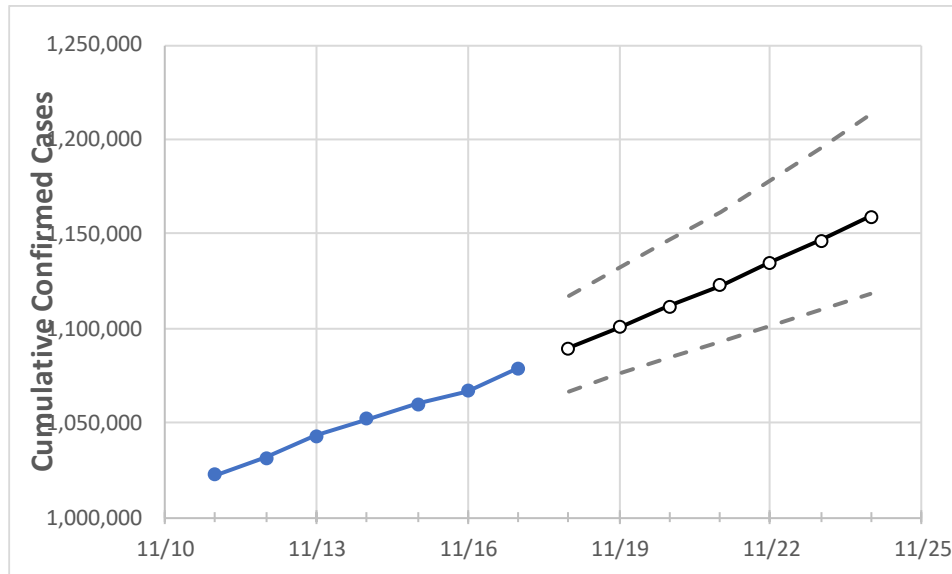
	Actual Confirmed Cases On:				Projected Cases For:						
	11/14	11/15	11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23	11/24
Texas	1,052,229	1,059,753	1,066,918	1,078,875	1,089,462	1,100,327	1,111,476	1,122,915	1,134,649	1,146,687	1,159,033

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:						
	11/14	11/15	11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23	11/24
Bexar	69,723	70,042	70,236	70,528	70,843	71,165	71,494	71,829	72,171	72,521	72,878
Brazoria	13,243	13,308	13,336	13,364	13,415	13,467	13,521	13,575	13,631	13,689	13,747
Brazos	8,498	8,584	8,675	8,721	8,795	8,871	8,950	9,031	9,116	9,204	9,295
Collin	21,431	21,665	21,677	21,689	21,808	21,928	22,048	22,168	22,288	22,408	22,528
Dallas	107,741	109,022	110,098	111,174	112,140	113,140	114,175	115,247	116,357	117,505	118,694
Denton	16,886	17,022	17,157	17,347	17,518	17,695	17,877	18,065	18,259	18,459	18,665
El Paso	72,238	73,340	74,973	76,075	77,742	79,422	81,115	82,820	84,539	86,269	88,012
Ellis	5,714	5,733	5,751	5,770	5,815	5,860	5,907	5,956	6,005	6,056	6,109
Fort Bend	18,761	18,773	18,785	18,873	18,930	18,989	19,050	19,113	19,178	19,245	19,314
Galveston	13,457	13,570	13,633	13,696	13,769	13,843	13,921	14,001	14,083	14,168	14,256
Harris	173,436	174,493	175,414	175,959	176,931	177,929	178,956	180,010	181,094	182,207	183,351
Hidalgo	37,469	37,524	37,580	38,006	38,116	38,228	38,340	38,453	38,568	38,684	38,801
Johnson	4,399	4,436	4,472	4,509	4,551	4,595	4,640	4,687	4,735	4,785	4,837
Lubbock	24,846	25,038	25,810	26,145	26,579	27,023	27,475	27,937	28,407	28,887	29,376
McLennan	11,956	12,106	12,215	12,323	12,489	12,661	12,840	13,027	13,221	13,423	13,633
Montgomery	14,973	15,034	15,095	15,227	15,302	15,379	15,457	15,536	15,616	15,698	15,781
Tarrant	80,492	82,015	82,915	83,647	84,780	85,942	87,135	88,360	89,616	90,906	92,229
Travis	34,504	34,612	34,769	35,020	35,237	35,463	35,698	35,941	36,195	36,458	36,731
Williamson	10,900	10,958	11,016	11,084	11,177	11,275	11,377	11,485	11,598	11,716	11,841

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:		
	11/14	11/15	11/16	11/17	11/19	11/21	11/23
Bexar	69,723	70,042	70,236	70,528	71,165 (14,233) [3,416] {1,708}	71,829 (14,366) [3,448] {1,724}	72,521 (14,504) [3,481] {1,741}
Brazoria	13,243	13,308	13,336	13,364	13,467 (2,693) [646] {323}	13,575 (2,715) [652] {326}	13,689 (2,738) [657] {329}
Brazos	8,498	8,584	8,675	8,721	8,871 (1,774) [426] {213}	9,031 (1,806) [434] {217}	9,204 (1,841) [442] {221}
Collin	21,431	21,665	21,677	21,689	21,928 (4,386) [1,053] {526}	22,168 (4,434) [1,064] {532}	22,408 (4,482) [1,076] {538}
Dallas	107,741	109,022	110,098	111,174	113,140 (22,628) [5,431] {2,715}	115,247 (23,049) [5,532] {2,766}	117,505 (23,501) [5,640] {2,820}
Denton	16,886	17,022	17,157	17,347	17,695 (3,539) [849] {425}	18,065 (3,613) [867] {434}	18,459 (3,692) [886] {443}
El Paso	72,238	73,340	74,973	76,075	79,422 (15,884) [3,812] {1,906}	82,820 (16,564) [3,975] {1,988}	86,269 (17,254) [4,141] {2,070}
Ellis	5,714	5,733	5,751	5,770	5,860 (1,172) [281] {141}	5,956 (1,191) [286] {143}	6,056 (1,211) [291] {145}
Fort Bend	18,761	18,773	18,785	18,873	18,989 (3,798) [911] {456}	19,113 (3,823) [917] {459}	19,245 (3,849) [924] {462}
Galveston	13,457	13,570	13,633	13,696	13,843 (2,769) [664] {332}	14,001 (2,800) [672] {336}	14,168 (2,834) [680] {340}
Harris	173,436	174,493	175,414	175,959	177,929 (35,586) [8,541] {4,270}	180,010 (36,002) [8,640] {4,320}	182,207 (36,441) [8,746] {4,373}
Hidalgo	37,469	37,524	37,580	38,006	38,228 (7,646) [1,835] {917}	38,453 (7,691) [1,846] {923}	38,684 (7,737) [1,857] {928}
Johnson	4,399	4,436	4,472	4,509	4,595 (919) [221] {110}	4,687 (937) [225] {112}	4,785 (957) [230] {115}
Lubbock	24,846	25,038	25,810	26,145	27,023 (5,405) [1,297] {649}	27,937 (5,587) [1,341] {670}	28,887 (5,777) [1,387] {693}
McLennan	11,956	12,106	12,215	12,323	12,661 (2,532) [608] {304}	13,027 (2,605) [625] {313}	13,423 (2,685) [644] {322}
Montgomery	14,973	15,034	15,095	15,227	15,379 (3,076) [738] {369}	15,536 (3,107) [746] {373}	15,698 (3,140) [754] {377}
Tarrant	80,492	82,015	82,915	83,647	85,942 (17,188) [4,125] {2,063}	88,360 (17,672) [4,241] {2,121}	90,906 (18,181) [4,363] {2,182}
Travis	34,504	34,612	34,769	35,020	35,463 (7,093) [1,702] {851}	35,941 (7,188) [1,725] {863}	36,458 (7,292) [1,750] {875}
Williamson	10,900	10,958	11,016	11,084	11,275 (2,255) [541] {271}	11,485 (2,297) [551] {276}	11,716 (2,343) [562] {281}

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.