IEM's AI Modeling: Short-term COVID-19 Projections

Date: 11/24/20

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 11/24/20 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.

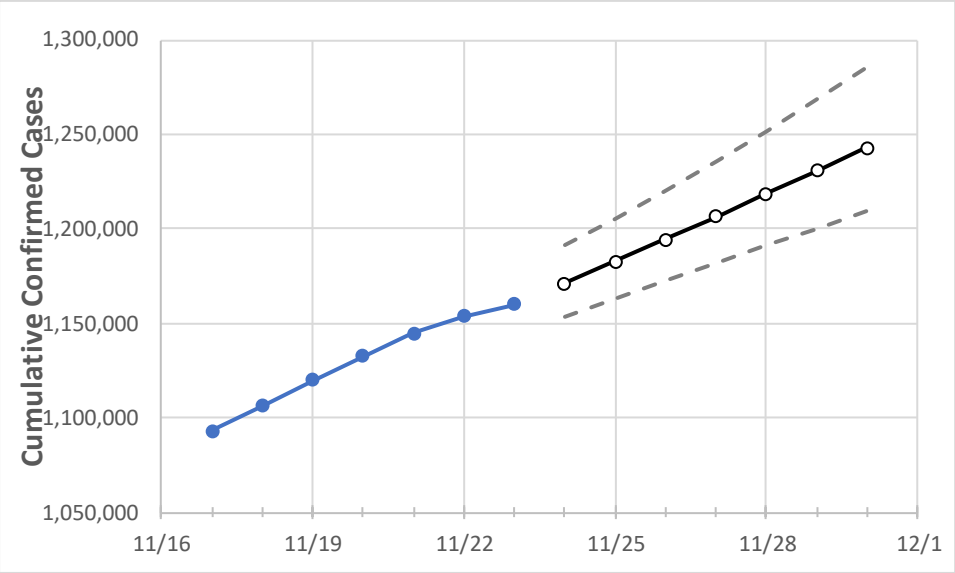
IEM's Modeling Lead

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:						
	11/20	11/21	11/22	11/23	11/24	11/25	11/26	11/27	11/28	11/29	11/30
Texas	1,132,690	1,144,509	1,153,612	1,159,863	1,171,287	1,182,858	1,194,580	1,206,455	1,218,486	1,230,674	1,243,023

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:						
	11/20	11/21	11/22	11/23	11/24	11/25	11/26	11/27	11/28	11/29	11/30
Bexar	72,313	72,805	73,882	73,882	74,443	75,032	75,650	76,297	76,977	77,689	78,436
Brazoria	13,626	13,722	13,824	13,857	13,929	14,004	14,081	14,161	14,243	14,328	14,416
Brazos	10,392	10,495	10,576	10,655	10,771	10,892	11,017	11,147	11,283	11,423	11,570
Collin	22,369	22,691	23,381	23,784	23,905	24,027	24,148	24,269	24,391	24,512	24,633
Dallas	126,141	128,324	130,186	130,186	132,210	134,343	136,589	138,956	141,448	144,073	146,836
Denton	21,157	21,453	21,695	21,937	22,275	22,630	23,001	23,391	23,799	24,227	24,675
El Paso	79,162	80,291	81,179	81,511	82,317	83,086	83,822	84,524	85,196	85,838	86,451
Ellis	6,070	6,107	6,107	6,107	6,153	6,201	6,250	6,301	6,354	6,408	6,464
Fort Bend	19,223	19,352	19,466	19,580	19,664	19,751	19,842	19,936	20,034	20,136	20,242
Galveston	13,922	14,020	14,126	14,126	14,213	14,303	14,397	14,493	14,593	14,696	14,803
Harris	179,911	181,361	182,192	183,252	184,546	185,884	187,268	188,698	190,177	191,705	193,285
Hidalgo	40,085	40,085	40,085	40,085	40,321	40,569	40,831	41,106	41,396	41,702	42,024
Johnson	4,788	4,842	4,842	4,842	4,902	4,965	5,032	5,102	5,175	5,252	5,332
Lubbock	27,660	28,134	28,375	28,873	29,317	29,767	30,223	30,685	31,153	31,626	32,105
McLennan	12,947	13,156	13,375	13,375	13,608	13,852	14,107	14,375	14,656	14,950	15,257
Montgomery	15,920	16,130	16,339	16,549	16,749	16,964	17,195	17,443	17,709	17,994	18,300
Tarrant	88,948	90,316	91,853	92,977	94,557	96,196	97,894	99,656	101,481	103,373	105,334
Travis	35,984	36,175	36,436	36,436	36,757	37,094	37,447	37,818	38,208	38,616	39,046
Williamson	11,559	11,684	11,810	11,935	12,078	12,230	12,391	12,561	12,741	12,931	13,133

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:		
	11/20	11/21	11/22	11/23	11/25	11/27	11/29
Bexar	72,313	72,805	73,882	73,882	75,032 (15,006) [3,602] {1,801}	76,297 (15,259) [3,662] {1,831}	77,689 (15,538) [3,729] {1,865}
Brazoria	13,626	13,722	13,824	13,857	14,004 (2,801) [672] {336}	14,161 (2,832) [680] {340}	14,328 (2,866) [688] {344}
Brazos	10,392	10,495	10,576	10,655	10,892 (2,178) [523] {261}	11,147 (2,229) [535] {268}	11,423 (2,285) [548] {274}
Collin	22,369	22,691	23,381	23,784	24,027 (4,805) [1,153] {577}	24,269 (4,854) [1,165] {582}	24,512 (4,902) [1,177] {588}
Dallas	126,141	128,324	130,186	130,186	134,343 (26,869) [6,448] {3,224}	138,956 (27,791) [6,670] {3,335}	144,073 (28,815) [6,915] {3,458}
Denton	21,157	21,453	21,695	21,937	22,630 (4,526) [1,086] {543}	23,391 (4,678) [1,123] {561}	24,227 (4,845) [1,163] {581}
El Paso	79,162	80,291	81,179	81,511	83,086 (16,617) [3,988] {1,994}	84,524 (16,905) [4,057] {2,029}	85,838 (17,168) [4,120] {2,060}
Ellis	6,070	6,107	6,107	6,107	6,201 (1,240) [298] {149}	6,301 (1,260) [302] {151}	6,408 (1,282) [308] {154}
Fort Bend	19,223	19,352	19,466	19,580	19,751 (3,950) [948] {474}	19,936 (3,987) [957] {478}	20,136 (4,027) [967] {483}
Galveston	13,922	14,020	14,126	14,126	14,303 (2,861) [687] {343}	14,493 (2,899) [696] {348}	14,696 (2,939) [705] {353}
Harris	179,911	181,361	182,192	183,252	185,884 (37,177) [8,922] {4,461}	188,698 (37,740) [9,058] {4,529}	191,705 (38,341) [9,202] {4,601}
Hidalgo	40,085	40,085	40,085	40,085	40,569 (8,114) [1,947] {974}	41,106 (8,221) [1,973] {987}	41,702 (8,340) [2,002] {1,001}
Johnson	4,788	4,842	4,842	4,842	4,965 (993) [238] {119}	5,102 (1,020) [245] {122}	5,252 (1,050) [252] {126}
Lubbock	27,660	28,134	28,375	28,873	29,767 (5,953) [1,429] {714}	30,685 (6,137) [1,473] {736}	31,626 (6,325) [1,518] {759}
McLennan	12,947	13,156	13,375	13,375	13,852 (2,770) [665] {332}	14,375 (2,875) [690] {345}	14,950 (2,990) [718] {359}
Montgomery	15,920	16,130	16,339	16,549	16,964 (3,393) [814] {407}	17,443 (3,489) [837] {419}	17,994 (3,599) [864] {432}
Tarrant	88,948	90,316	91,853	92,977	96,196 (19,239) [4,617] {2,309}	99,656 (19,931) [4,783] {2,392}	103,373 (20,675) [4,962] {2,481}
Travis	35,984	36,175	36,436	36,436	37,094 (7,419) [1,780] {890}	37,818 (7,564) [1,815] {908}	38,616 (7,723) [1,854] {927}
Williamson	11,559	11,684	11,810	11,935	12,230 (2,446) [587] {294}	12,561 (2,512) [603] {301}	12,931 (2,586) [621] {310}

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.