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

Date: 10/26/20

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 10/26/20 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.

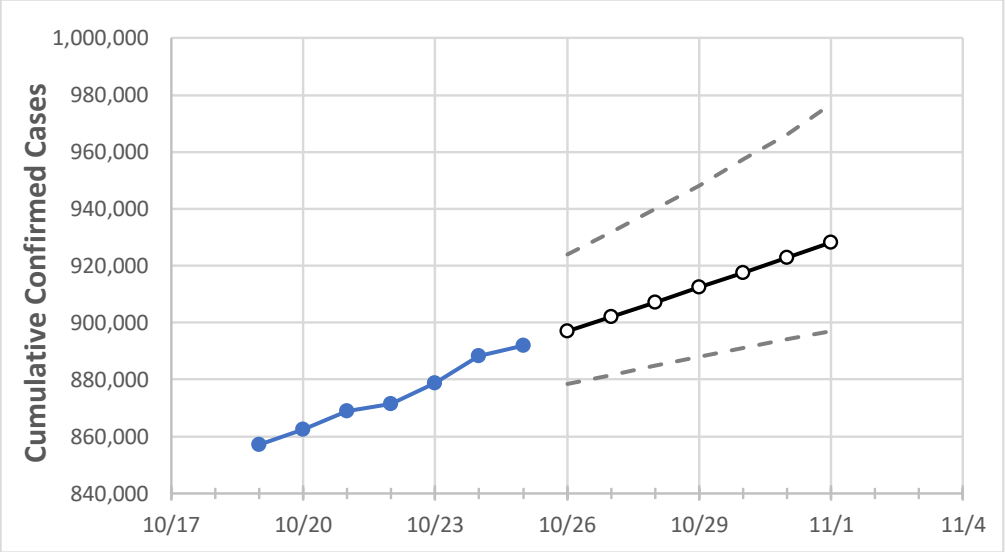
IEM's Modeling Lead

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:						
	10/22	10/23	10/24	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1
Texas	871,453	878,567	888,362	892,006	896,995	902,044	907,154	912,324	917,557	922,852	928,210

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:						
	10/22	10/23	10/24	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1
Bexar	64,014	64,261	64,476	64,616	64,838	65,066	65,300	65,539	65,783	66,034	66,291
Brazoria	12,083	12,105	12,191	12,243	12,275	12,308	12,340	12,373	12,406	12,439	12,472
Brazos	7,404	7,430	7,464	7,495	7,525	7,554	7,583	7,612	7,640	7,668	7,696
Collin	17,185	17,248	17,611	17,690	17,785	17,880	17,976	18,074	18,172	18,271	18,371
Dallas	91,489	91,664	92,197	92,845	93,241	93,643	94,052	94,466	94,886	95,313	95,745
Denton	13,839	13,904	14,157	14,260	14,351	14,445	14,541	14,639	14,739	14,842	14,947
El Paso	35,393	36,025	38,554	39,326	40,404	41,546	42,755	44,036	45,392	46,827	48,346
Ellis	4,806	4,816	4,875	4,875	4,892	4,909	4,928	4,946	4,966	4,987	5,008
Fort Bend	17,362	17,392	17,392	17,392	17,419	17,446	17,473	17,500	17,528	17,555	17,583
Galveston	12,197	12,222	12,297	12,368	12,403	12,439	12,476	12,515	12,556	12,598	12,643
Harris	156,742	157,392	158,379	158,758	159,272	159,789	160,310	160,834	161,362	161,894	162,429
Hidalgo	34,761	34,970	34,970	34,970	35,052	35,135	35,217	35,300	35,383	35,466	35,550
Johnson	3,492	3,505	3,588	3,588	3,602	3,617	3,631	3,646	3,660	3,675	3,689
Lubbock	16,274	16,417	16,911	17,141	17,417	17,700	17,992	18,291	18,598	18,913	19,236
McLennan	9,603	9,632	9,772	9,846	9,903	9,961	10,019	10,077	10,136	10,195	10,254
Montgomery	13,436	13,575	13,575	13,575	13,664	13,755	13,848	13,942	14,039	14,138	14,239
Tarrant	61,527	62,375	63,150	63,792	64,536	65,306	66,102	66,924	67,774	68,653	69,561
Travis	31,327	31,411	31,493	31,551	31,638	31,725	31,812	31,900	31,987	32,075	32,163
Williamson	9,289	9,335	9,335	9,335	9,361	9,386	9,412	9,439	9,465	9,492	9,519

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:		
	10/22	10/23	10/24	10/25	10/27	10/29	10/31
Bexar	64,014	64,261	64,476	64,616	65,066 (13,013) [3,123] {1,562}	65,539 (13,108) [3,146] {1,573}	66,034 (13,207) [3,170] {1,58
Brazoria	12,083	12,105	12,191	12,243	12,308 (2,462) [591] {295}	12,373 (2,475) [594] {297}	12,439 (2,488) [597] {299}
Brazos	7,404	7,430	7,464	7,495	7,554 (1,511) [363] {181}	7,612 (1,522) [365] {183}	7,668 (1,534) [368] {184}
Collin	17,185	17,248	17,611	17,690	17,880 (3,576) [858] {429}	18,074 (3,615) [868] {434}	18,271 (3,654) [877] {439}
Dallas	91,489	91,664	92,197	92,845	93,643 (18,729) [4,495] {2,247}	94,466 (18,893) [4,534] {2,267}	95,313 (19,063) [4,575] {2,28
Denton	13,839	13,904	14,157	14,260	14,445 (2,889) [693] {347}	14,639 (2,928) [703] {351}	14,842 (2,968) [712] {356}
El Paso	35,393	36,025	38,554	39,326	41,546 (8,309) [1,994] {997}	44,036 (8,807) [2,114] {1,057}	46,827 (9,365) [2,248] {1,124
Ellis	4,806	4,816	4,875	4,875	4,909 (982) [236] {118}	4,946 (989) [237] {119}	4,987 (997) [239] {120}
Fort Bend	17,362	17,392	17,392	17,392	17,446 (3,489) [837] {419}	17,500 (3,500) [840] {420}	17,555 (3,511) [843] {421}
Galveston	12,197	12,222	12,297	12,368	12,439 (2,488) [597] {299}	12,515 (2,503) [601] {300}	12,598 (2,520) [605] {302}
Harris	156,742	157,392	158,379	158,758	159,789 (31,958) [7,670] {3,835}	160,834 (32,167) [7,720] {3,860}	161,894 (32,379) [7,771] {3,88
Hidalgo	34,761	34,970	34,970	34,970	35,135 (7,027) [1,686] {843}	35,300 (7,060) [1,694] {847}	35,466 (7,093) [1,702] {851
Johnson	3,492	3,505	3,588	3,588	3,617 (723) [174] {87}	3,646 (729) [175] {87}	3,675 (735) [176] {88}
Lubbock	16,274	16,417	16,911	17,141	17,700 (3,540) [850] {425}	18,291 (3,658) [878] {439}	18,913 (3,783) [908] {454}
McLennan	9,603	9,632	9,772	9,846	9,961 (1,992) [478] {239}	10,077 (2,015) [484] {242}	10,195 (2,039) [489] {245}
Montgomery	13,436	13,575	13,575	13,575	13,755 (2,751) [660] {330}	13,942 (2,788) [669] {335}	14,138 (2,828) [679] {339}
Tarrant	61,527	62,375	63,150	63,792	65,306 (13,061) [3,135] {1,567}	66,924 (13,385) [3,212] {1,606}	68,653 (13,731) [3,295] {1,64
Travis	31,327	31,411	31,493	31,551	31,725 (6,345) [1,523] {761}	31,900 (6,380) [1,531] {766}	32,075 (6,415) [1,540] {770
Williamson	9,289	9,335	9,335	9,335	9,386 (1,877) [451] {225}	9,439 (1,888) [453] {227}	9,492 (1,898) [456] {228}

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.