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

Date: 7/13/20

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 20%, and are often within 10%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 7/13/20 11 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.

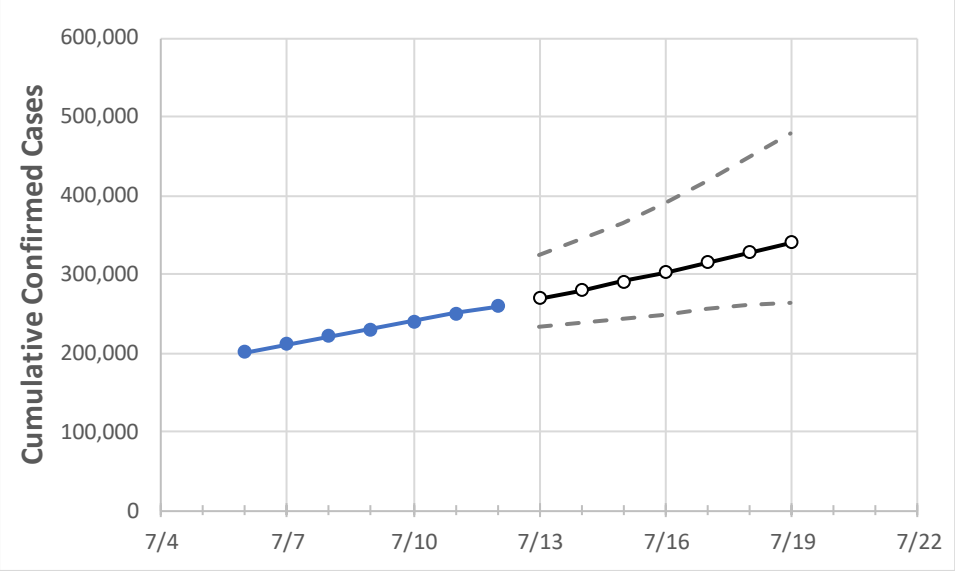
IEM's Modeling Lead

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:						
	7/9	7/10	7/11	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19
Texas	230,301	240,103	250,456	258,658	268,780	279,396	290,530	302,205	314,447	327,280	340,732

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:						
	7/9	7/10	7/11	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19
Bexar	16,725	17,679	18,602	19,137	19,803	20,494	21,211	21,954	22,724	23,524	24,353
Brazoria	3,146	3,272	3,358	3,458	3,579	3,707	3,841	3,982	4,130	4,286	4,450
Brazos	2,704	2,804	2,901	2,961	3,038	3,115	3,193	3,273	3,352	3,433	3,515
Collin	3,948	4,108	4,308	4,459	4,631	4,812	5,004	5,207	5,422	5,648	5,888
Dallas	29,160	30,361	31,525	32,626	34,008	35,480	37,049	38,720	40,500	42,395	44,413
Denton	3,582	3,697	3,810	3,937	4,036	4,138	4,242	4,349	4,459	4,571	4,686
El Paso	8,385	8,746	9,099	9,510	9,939	10,397	10,885	11,407	11,964	12,558	13,192
Ellis	1,424	1,485	1,510	1,510	1,603	1,674	1,735	1,799	1,867	1,936	2,006
Fort Bend	4,413	4,524	4,617	4,758	4,855	4,958	5,069	5,186	5,312	5,445	5,588
Galveston	5,063	5,320	5,630	5,873	6,154	6,449	6,758	7,081	7,421	7,778	8,152
Harris	40,012	40,919	42,000	43,939	45,227	46,569	47,967	49,423	50,939	52,516	54,158
Hidalgo	5,782	6,060	7,334	7,727	8,023	8,331	8,651	8,984	9,330	9,691	10,065
Johnson	769	779	788	788	821	855	891	929	968	1,010	1,053
Lubbock	3,231	3,376	3,524	3,668	3,810	3,958	4,113	4,276	4,445	4,623	4,808
McLennan	2,283	2,438	2,442	2,537	2,635	2,736	2,842	2,952	3,067	3,186	3,311
Montgomery	2,784	2,876	3,007	3,007	3,113	3,225	3,344	3,470	3,603	3,745	3,894
Tarrant	16,180	16,700	17,334	17,757	18,310	18,889	19,495	20,129	20,792	21,486	22,212
Travis	13,161	13,864	14,304	14,622	15,086	15,564	16,054	16,558	17,076	17,608	18,155
Williamson	3,442	3,617	3,654	3,745	3,891	4,044	4,203	4,368	4,539	4,718	4,904

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:		
	7/9	7/10	7/11	7/12	7/14	7/16	7/18
Bexar	16,725	17,679	18,602	19,137	20,494 (4,099) [984] {492}	21,954 (4,391) [1,054] {527}	23,524 (4,705) [1,129] {565}
Brazoria	3,146	3,272	3,358	3,458	3,707 (741) [178] {89}	3,982 (796) [191] {96}	4,286 (857) [206] {103}
Brazos	2,704	2,804	2,901	2,961	3,115 (623) [150] {75}	3,273 (655) [157] {79}	3,433 (687) [165] {82}
Collin	3,948	4,108	4,308	4,459	4,812 (962) [231] {115}	5,207 (1,041) [250] {125}	5,648 (1,130) [271] {136}
Dallas	29,160	30,361	31,525	32,626	35,480 (7,096) [1,703] {852}	38,720 (7,744) [1,859] {929}	42,395 (8,479) [2,035] {1,017}
Denton	3,582	3,697	3,810	3,937	4,138 (828) [199] {99}	4,349 (870) [209] {104}	4,571 (914) [219] {110}
El Paso	8,385	8,746	9,099	9,510	10,397 (2,079) [499] {250}	11,407 (2,281) [548] {274}	12,558 (2,512) [603] {301}
Ellis	1,424	1,485	1,510	1,510	1,674 (335) [80] {40}	1,799 (360) [86] {43}	1,936 (387) [93] {46}
Fort Bend	4,413	4,524	4,617	4,758	4,958 (992) [238] {119}	5,186 (1,037) [249] {124}	5,445 (1,089) [261] {131}
Galveston	5,063	5,320	5,630	5,873	6,449 (1,290) [310] {155}	7,081 (1,416) [340] {170}	7,778 (1,556) [373] {187}
Harris	40,012	40,919	42,000	43,939	46,569 (9,314) [2,235] {1,118}	49,423 (9,885) [2,372] {1,186}	52,516 (10,503) [2,521] {1,260}
Hidalgo	5,782	6,060	7,334	7,727	8,331 (1,666) [400] {200}	8,984 (1,797) [431] {216}	9,691 (1,938) [465] {233}
Johnson	769	779	788	788	855 (171) [41] {21}	929 (186) [45] {22}	1,010 (202) [48] {24}
Lubbock	3,231	3,376	3,524	3,668	3,958 (792) [190] {95}	4,276 (855) [205] {103}	4,623 (925) [222] {111}
McLennan	2,283	2,438	2,442	2,537	2,736 (547) [131] {66}	2,952 (590) [142] {71}	3,186 (637) [153] {76}
Montgomery	2,784	2,876	3,007	3,007	3,225 (645) [155] {77}	3,470 (694) [167] {83}	3,745 (749) [180] {90}
Tarrant	16,180	16,700	17,334	17,757	18,889 (3,778) [907] {453}	20,129 (4,026) [966] {483}	21,486 (4,297) [1,031] {516}
Travis	13,161	13,864	14,304	14,622	15,564 (3,113) [747] {374}	16,558 (3,312) [795] {397}	17,608 (3,522) [845] {423}
Williamson	3,442	3,617	3,654	3,745	4,044 (809) [194] {97}	4,368 (874) [210] {105}	4,718 (944) [226] {113}

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.