

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

Date: 7/7/20

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 7/7/20 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.

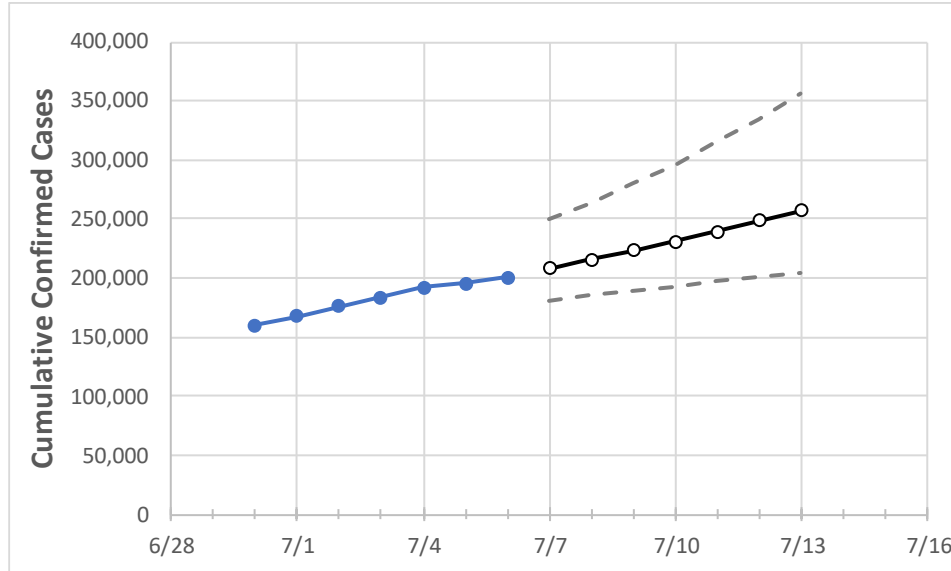
IEM's Modeling Lead

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:						
	7/3	7/4	7/5	7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13
Texas	183,520	191,782	195,236	200,557	207,842	215,396	223,227	231,347	239,766	248,496	257,548

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:						
	7/3	7/4	7/5	7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13
Bexar	12,878	14,212	14,553	14,751	15,369	16,010	16,677	17,371	18,094	18,847	19,632
Brazoria	2,516	2,626	2,715	2,829	2,934	3,045	3,162	3,285	3,416	3,554	3,699
Brazos	2,228	2,331	2,401	2,484	2,599	2,721	2,850	2,987	3,132	3,286	3,448
Collin	3,199	3,321	3,409	3,521	3,660	3,809	3,969	4,140	4,323	4,519	4,728
Dallas	22,590	23,675	24,778	25,840	26,791	27,800	28,869	30,003	31,206	32,481	33,832
Denton	3,032	3,184	3,279	3,338	3,437	3,538	3,643	3,752	3,864	3,979	4,099
El Paso	6,665	6,953	7,207	7,461	7,772	8,104	8,460	8,839	9,245	9,678	10,141
Ellis	978	1,046	1,046	1,046	1,130	1,175	1,216	1,258	1,296	1,336	1,376
Fort Bend	3,999	4,120	4,120	4,120	4,182	4,245	4,308	4,372	4,437	4,503	4,570
Galveston	3,778	3,990	3,990	3,990	4,295	4,463	4,626	4,787	4,948	5,112	5,280
Harris	34,108	35,316	35,913	36,597	37,484	38,376	39,274	40,178	41,087	42,003	42,926
Johnson	526	553	553	553	605	632	658	683	707	730	753
Lubbock	2,620	2,620	2,620	2,620	2,810	2,900	2,989	3,080	3,169	3,255	3,341
McLennan	1,292	1,563	1,636	1,684	1,837	1,990	2,134	2,292	2,443	2,606	2,760
Montgomery	2,353	2,353	2,353	2,353	2,446	2,544	2,648	2,757	2,872	2,993	3,122
Tarrant	13,423	13,618	13,813	14,008	14,347	14,692	15,044	15,402	15,766	16,138	16,516
Travis	10,695	11,009	11,131	11,679	12,186	12,724	13,294	13,899	14,542	15,223	15,946
Williamson	2,388	2,469	2,469	2,469	2,583	2,702	2,824	2,952	3,084	3,221	3,362

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:											
	7/3	7/4	7/5	7/6	7/8				7/10				7/12			
Bexar	12,878	14,212	14,553	14,751	16,010	(3,202)	[768]	{384}	17,371	(3,474)	[834]	{417}	18,847	(3,769)	[905]	{452}
Brazoria	2,516	2,626	2,715	2,829	3,045	(609)	[146]	{73}	3,285	(657)	[158]	{79}	3,554	(711)	[171]	{85}
Brazos	2,228	2,331	2,401	2,484	2,721	(544)	[131]	{65}	2,987	(597)	[143]	{72}	3,286	(657)	[158]	{79}
Collin	3,199	3,321	3,409	3,521	3,809	(762)	[183]	{91}	4,140	(828)	[199]	{99}	4,519	(904)	[217]	{108}
Dallas	22,590	23,675	24,778	25,840	27,800	(5,560)	[1,334]	{667}	30,003	(6,001)	[1,440]	{720}	32,481	(6,496)	[1,559]	{780}
Denton	3,032	3,184	3,279	3,338	3,538	(708)	[170]	{85}	3,752	(750)	[180]	{90}	3,979	(796)	[191]	{96}
El Paso	6,665	6,953	7,207	7,461	8,104	(1,621)	[389]	{195}	8,839	(1,768)	[424]	{212}	9,678	(1,936)	[465]	{232}
Ellis	978	1,046	1,046	1,046	1,175	(235)	[56]	{28}	1,258	(252)	[60]	{30}	1,336	(267)	[64]	{32}
Fort Bend	3,999	4,120	4,120	4,120	4,245	(849)	[204]	{102}	4,372	(874)	[210]	{105}	4,503	(901)	[216]	{108}
Galveston	3,778	3,990	3,990	3,990	4,463	(893)	[214]	{107}	4,787	(957)	[230]	{115}	5,112	(1,022)	[245]	{123}
Harris	34,108	35,316	35,913	36,597	38,376	(7,675)	[1,842]	{921}	40,178	(8,036)	[1,929]	{964}	42,003	(8,401)	[2,016]	{1,008}
Johnson	526	553	553	553	632	(126)	[30]	{15}	683	(137)	[33]	{16}	730	(146)	[35]	{18}
Lubbock	2,620	2,620	2,620	2,620	2,900	(580)	[139]	{70}	3,080	(616)	[148]	{74}	3,255	(651)	[156]	{78}
McLennan	1,292	1,563	1,636	1,684	1,990	(398)	[96]	{48}	2,292	(458)	[110]	{55}	2,606	(521)	[125]	{63}
Montgomery	2,353	2,353	2,353	2,353	2,544	(509)	[122]	{61}	2,757	(551)	[132]	{66}	2,993	(599)	[144]	{72}
Tarrant	13,423	13,618	13,813	14,008	14,692	(2,938)	[705]	{353}	15,402	(3,080)	[739]	{370}	16,138	(3,228)	[775]	{387}
Travis	10,695	11,009	11,131	11,679	12,724	(2,545)	[611]	{305}	13,899	(2,780)	[667]	{334}	15,223	(3,045)	[731]	{365}
Williamson	2,388	2,469	2,469	2,469	2,702	(540)	[130]	{65}	2,952	(590)	[142]	{71}	3,221	(644)	[155]	{77}

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.