

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

Date: 6/25/20

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 6/25/20 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.

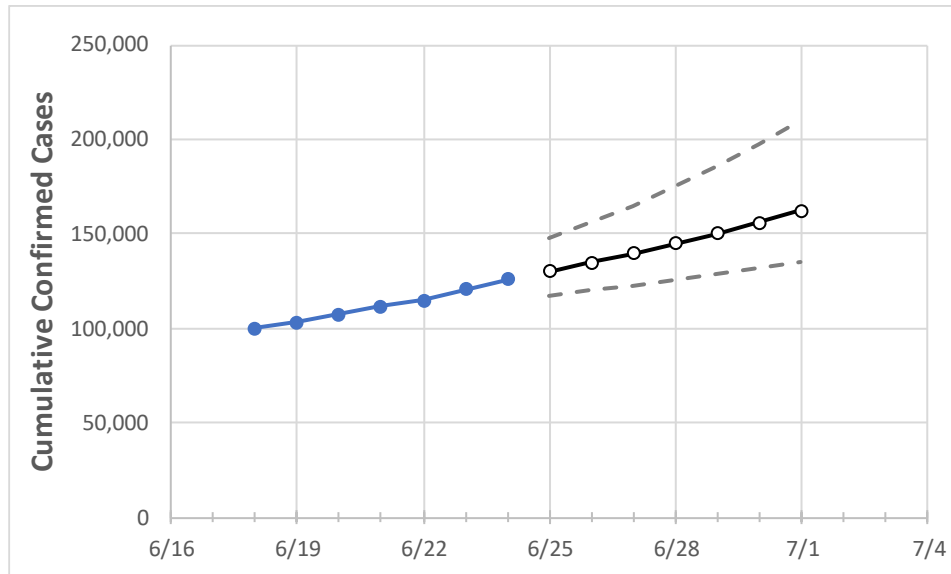
IEM's Modeling Lead

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:						
	6/21	6/22	6/23	6/24	6/25	6/26	6/27	6/28	6/29	6/30	7/1
Texas	111,554	114,833	120,365	125,921	130,204	134,769	139,632	144,813	150,333	156,215	162,480

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:						
	6/21	6/22	6/23	6/24	6/25	6/26	6/27	6/28	6/29	6/30	7/1
Bexar	6,344	6,882	7,156	7,467	7,737	8,154	8,541	8,909	9,270	9,659	10,069
Brazoria	1,728	1,762	1,814	1,838	1,871	1,916	1,964	2,009	2,057	2,100	2,147
Brazos	1,225	1,244	1,260	1,305	1,358	1,416	1,479	1,547	1,620	1,700	1,787
Collin	2,189	2,223	2,250	2,359	2,418	2,480	2,548	2,620	2,697	2,780	2,868
Dallas	16,437	16,845	17,299	17,744	18,172	18,613	19,068	19,537	20,021	20,519	21,033
Denton	2,113	2,163	2,219	2,302	2,372	2,446	2,525	2,610	2,701	2,798	2,902
El Paso	4,488	4,553	4,677	4,809	4,896	4,985	5,077	5,171	5,267	5,365	5,466
Ellis	525	532	539	684	696	708	721	735	749	763	779
Fort Bend	2,951	3,069	3,132	3,176	3,243	3,316	3,395	3,480	3,571	3,670	3,776
Galveston	1,784	1,867	1,968	2,040	2,150	2,270	2,402	2,546	2,704	2,877	3,067
Harris	20,874	21,053	23,047	24,421	25,151	25,930	26,760	27,646	28,590	29,597	30,671
Johnson	261	264	267	314	320	327	334	341	349	357	365
Lubbock	1,288	1,320	1,407	1,547	1,660	1,737	1,829	1,921	1,997	2,089	2,168
McLennan	303	354	371	421	460	491	521	556	589	619	653
Montgomery	1,586	1,616	1,647	1,737	1,794	1,856	1,923	1,996	2,075	2,161	2,254
Tarrant	8,511	8,955	9,126	9,386	9,634	9,897	10,175	10,469	10,779	11,107	11,454
Travis	5,704	6,210	6,339	6,596	6,842	7,106	7,389	7,694	8,021	8,372	8,749
Williamson	1,237	1,337	1,411	1,498	1,579	1,653	1,732	1,799	1,869	1,947	2,021

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:											
	6/21	6/22	6/23	6/24	6/26				6/28				6/30			
Bexar	6,344	6,882	7,156	7,467	8,154	(1,631)	[391]	{196}	8,909	(1,782)	[428]	{214}	9,659	(1,932)	[464]	{232}
Brazoria	1,728	1,762	1,814	1,838	1,916	(383)	[92]	{46}	2,009	(402)	[96]	{48}	2,100	(420)	[101]	{50}
Brazos	1,225	1,244	1,260	1,305	1,416	(283)	[68]	{34}	1,547	(309)	[74]	{37}	1,700	(340)	[82]	{41}
Collin	2,189	2,223	2,250	2,359	2,480	(496)	[119]	{60}	2,620	(524)	[126]	{63}	2,780	(556)	[133]	{67}
Dallas	16,437	16,845	17,299	17,744	18,613	(3,723)	[893]	{447}	19,537	(3,907)	[938]	{469}	20,519	(4,104)	[985]	{492}
Denton	2,113	2,163	2,219	2,302	2,446	(489)	[117]	{59}	2,610	(522)	[125]	{63}	2,798	(560)	[134]	{67}
El Paso	4,488	4,553	4,677	4,809	4,985	(997)	[239]	{120}	5,171	(1,034)	[248]	{124}	5,365	(1,073)	[258]	{129}
Ellis	525	532	539	684	708	(142)	[34]	{17}	735	(147)	[35]	{18}	763	(153)	[37]	{18}
Fort Bend	2,951	3,069	3,132	3,176	3,316	(663)	[159]	{80}	3,480	(696)	[167]	{84}	3,670	(734)	[176]	{88}
Galveston	1,784	1,867	1,968	2,040	2,270	(454)	[109]	{54}	2,546	(509)	[122]	{61}	2,877	(575)	[138]	{69}
Harris	20,874	21,053	23,047	24,421	25,930	(5,186)	[1,245]	{622}	27,646	(5,529)	[1,327]	{663}	29,597	(5,919)	[1,421]	{710}
Johnson	261	264	267	314	327	(65)	[16]	{8}	341	(68)	[16]	{8}	357	(71)	[17]	{9}
Lubbock	1,288	1,320	1,407	1,547	1,737	(347)	[83]	{42}	1,921	(384)	[92]	{46}	2,089	(418)	[100]	{50}
McLennan	303	354	371	421	491	(98)	[24]	{12}	556	(111)	[27]	{13}	619	(124)	[30]	{15}
Montgomery	1,586	1,616	1,647	1,737	1,856	(371)	[89]	{45}	1,996	(399)	[96]	{48}	2,161	(432)	[104]	{52}
Tarrant	8,511	8,955	9,126	9,386	9,897	(1,979)	[475]	{238}	10,469	(2,094)	[502]	{251}	11,107	(2,221)	[533]	{267}
Travis	5,704	6,210	6,339	6,596	7,106	(1,421)	[341]	{171}	7,694	(1,539)	[369]	{185}	8,372	(1,674)	[402]	{201}
Williamson	1,237	1,337	1,411	1,498	1,653	(331)	[79]	{40}	1,799	(360)	[86]	{43}	1,947	(389)	[93]	{47}

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.