

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

Date: 9/27/21

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 9/27/21 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.

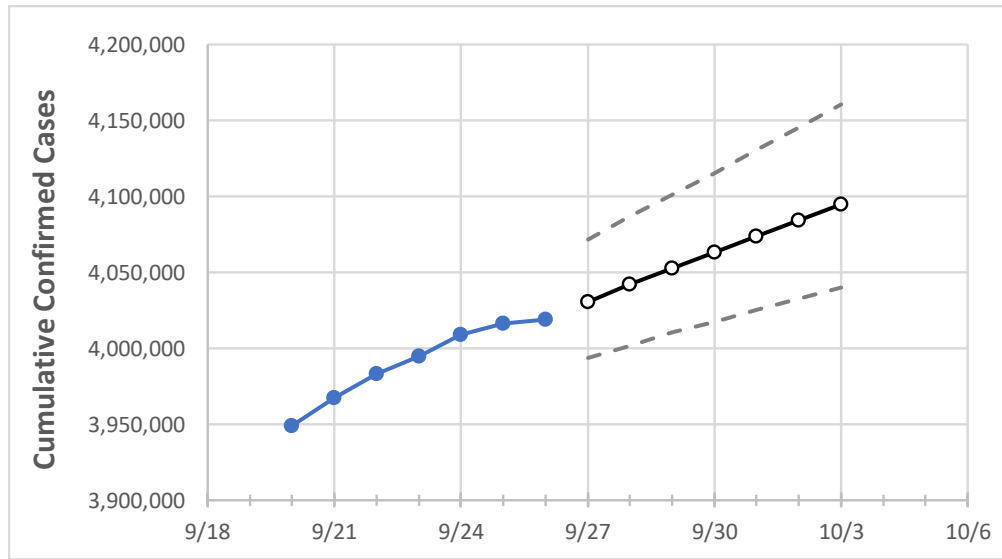
IEM's Modeling Lead

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:						
	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3
Texas	3,994,501	4,008,699	4,016,181	4,018,812	4,030,467	4,041,949	4,052,538	4,063,180	4,073,650	4,084,367	4,094,670

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 10%, and are often within 5%, of actual confirmed cases.

Texas Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3
Bexar	306,769	307,517	307,517	307,517	308,106	308,679	309,245	309,795	310,344	310,857	311,398
Brazoria	56,532	56,671	56,671	56,671	56,817	56,951	57,084	57,205	57,342	57,460	57,576
Brazos	34,941	35,087	35,087	35,087	35,373	35,664	35,954	36,271	36,593	36,918	37,265
Collin	121,831	122,158	122,350	122,807	123,140	123,463	123,780	124,064	124,374	124,659	124,948
Dallas	381,520	382,030	383,177	383,177	384,184	385,287	386,216	387,278	388,334	389,403	390,289
Denton	98,461	98,910	98,910	98,910	99,344	99,775	100,249	100,689	101,139	101,604	102,084
El Paso	144,274	144,369	144,463	144,605	144,710	144,815	144,920	145,022	145,128	145,237	145,342
Ellis	30,671	30,792	30,912	30,912	31,016	31,123	31,220	31,318	31,418	31,513	31,610
Fort Bend	93,565	93,565	93,565	93,565	93,954	94,310	94,679	95,046	95,447	95,798	96,214
Galveston	60,925	61,146	61,333	61,517	61,707	61,890	62,070	62,240	62,418	62,588	62,755
Harris	544,029	547,947	548,746	550,189	551,687	553,186	554,643	556,028	557,490	558,920	560,319
Hidalgo	114,138	114,454	114,454	114,454	114,853	115,251	115,642	116,060	116,505	116,942	117,406
Johnson	25,734	25,841	25,947	25,947	26,044	26,149	26,245	26,338	26,438	26,537	26,639
Lubbock	62,790	62,969	63,128	63,128	63,289	63,450	63,602	63,750	63,898	64,036	64,185
McLennan	39,817	39,918	40,030	40,030	40,183	40,326	40,473	40,603	40,742	40,886	41,017
Montgomery	83,713	83,949	83,949	83,949	84,188	84,415	84,653	84,872	85,080	85,298	85,504
Tarrant	339,572	340,606	340,606	340,606	341,589	342,557	343,473	344,370	345,236	346,134	346,897
Travis	113,743	114,060	114,060	114,060	114,358	114,627	114,903	115,154	115,418	115,681	115,959
Williamson	71,084	71,255	71,255	71,255	71,516	71,747	71,995	72,237	72,475	72,710	72,941

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:											
	9/23	9/24	9/25	9/26	9/28			9/30			10/2					
Bexar	306,769	307,517	307,517	307,517	308,679	(61,736)	[14,817]	{7,408}	309,795	(61,959)	[14,870]	{7,435}	310,857	(62,171)	[14,921]	{7,461}
Brazoria	56,532	56,671	56,671	56,671	56,951	(11,390)	[2,734]	{1,367}	57,205	(11,441)	[2,746]	{1,373}	57,460	(11,492)	[2,758]	{1,379}
Brazos	34,941	35,087	35,087	35,087	35,664	(7,133)	[1,712]	{856}	36,271	(7,254)	[1,741]	{870}	36,918	(7,384)	[1,772]	{886}
Collin	121,831	122,158	122,350	122,807	123,463	(24,693)	[5,926]	{2,963}	124,064	(24,813)	[5,955]	{2,978}	124,659	(24,932)	[5,984]	{2,992}
Dallas	381,520	382,030	383,177	383,177	385,287	(77,057)	[18,494]	{9,247}	387,278	(77,456)	[18,589]	{9,295}	389,403	(77,881)	[18,691]	{9,346}
Denton	98,461	98,910	98,910	98,910	99,775	(19,955)	[4,789]	{2,395}	100,689	(20,138)	[4,833]	{2,417}	101,604	(20,321)	[4,877]	{2,439}
El Paso	144,274	144,369	144,463	144,605	144,815	(28,963)	[6,951]	{3,476}	145,022	(29,004)	[6,961]	{3,481}	145,237	(29,047)	[6,971]	{3,486}
Ellis	30,671	30,792	30,912	30,912	31,123	(6,225)	[1,494]	{747}	31,318	(6,264)	[1,503]	{752}	31,513	(6,303)	[1,513]	{756}
Fort Bend	93,565	93,565	93,565	93,565	94,310	(18,862)	[4,527]	{2,263}	95,046	(19,009)	[4,562]	{2,281}	95,798	(19,160)	[4,598]	{2,299}
Galveston	60,925	61,146	61,333	61,517	61,890	(12,378)	[2,971]	{1,485}	62,240	(12,448)	[2,988]	{1,494}	62,588	(12,518)	[3,004]	{1,502}
Harris	544,029	547,947	548,746	550,189	553,186	(110,637)	[26,553]	{13,276}	556,028	(111,206)	[26,689]	{13,345}	558,920	(111,784)	[26,828]	{13,414}
Hidalgo	114,138	114,454	114,454	114,454	115,251	(23,050)	[5,532]	{2,766}	116,060	(23,212)	[5,571]	{2,785}	116,942	(23,388)	[5,613]	{2,807}
Johnson	25,734	25,841	25,947	25,947	26,149	(5,230)	[1,255]	{628}	26,338	(5,268)	[1,264]	{632}	26,537	(5,307)	[1,274]	{637}
Lubbock	62,790	62,969	63,128	63,128	63,450	(12,690)	[3,046]	{1,523}	63,750	(12,750)	[3,060]	{1,530}	64,036	(12,807)	[3,074]	{1,537}
McLennan	39,817	39,918	40,030	40,030	40,326	(8,065)	[1,936]	{968}	40,603	(8,121)	[1,949]	{974}	40,886	(8,177)	[1,963]	{981}
Montgomery	83,713	83,949	83,949	83,949	84,415	(16,883)	[4,052]	{2,026}	84,872	(16,974)	[4,074]	{2,037}	85,298	(17,060)	[4,094]	{2,047}
Tarrant	339,572	340,606	340,606	340,606	342,557	(68,511)	[16,443]	{8,221}	344,370	(68,874)	[16,530]	{8,265}	346,134	(69,227)	[16,614]	{8,307}
Travis	113,743	114,060	114,060	114,060	114,627	(22,925)	[5,502]	{2,751}	115,154	(23,031)	[5,527]	{2,764}	115,681	(23,136)	[5,553]	{2,776}
Williamson	71,084	71,255	71,255	71,255	71,747	(14,349)	[3,444]	{1,722}	72,237	(14,447)	[3,467]	{1,734}	72,710	(14,542)	[3,490]	{1,745}

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.