

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

Date: 1/7/22

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 1/7/22 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.

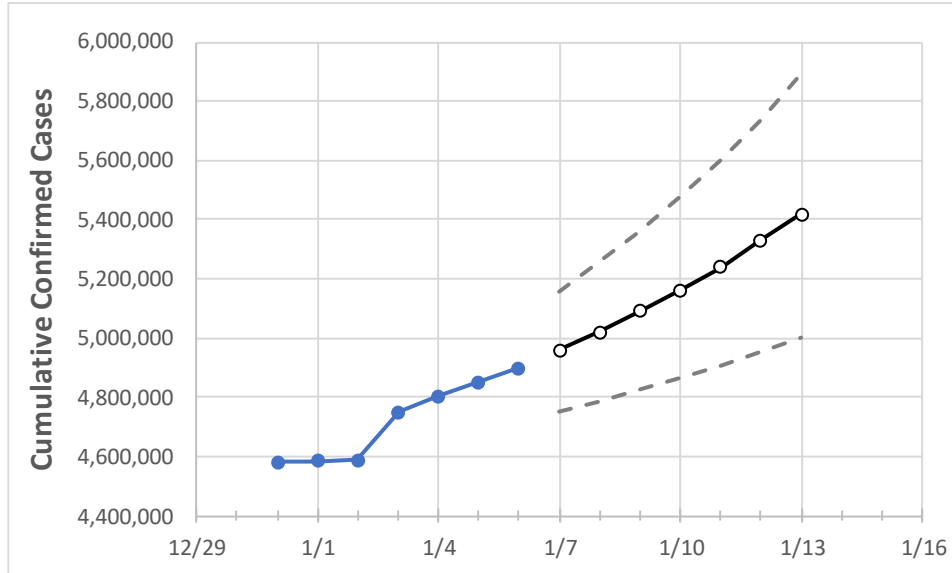
IEM's Modeling Lead

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:						
	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13

Texas 4,751,178 4,804,721 4,851,987 4,897,362 4,959,193 5,020,659 5,090,499 5,161,392 5,241,008 5,329,484 5,419,196

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:						
	1/3	1/4	1/5	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13
Bexar	353,333	358,217	361,426	364,040	368,342	373,132	378,259	383,851	390,001	396,788	404,121
Brazoria	70,498	71,557	72,536	73,137	74,210	75,340	76,551	77,862	79,185	80,660	82,186
Brazos	42,894	43,358	43,877	44,709	45,469	46,306	47,234	48,244	49,364	50,617	51,957
Collin	146,810	148,998	150,533	152,472	154,607	156,916	159,410	162,150	165,100	168,396	171,897
Dallas	451,602	457,058	461,225	465,748	471,252	477,273	483,840	491,051	498,821	507,425	516,876
Denton	121,828	123,507	124,870	126,785	128,664	130,719	132,989	135,487	138,213	141,164	144,433
El Paso	169,708	170,476	171,237	172,015	172,709	173,441	174,208	175,021	175,895	176,819	177,796
Ellis	36,730	37,129	37,472	37,817	38,224	38,671	39,159	39,688	40,260	40,879	41,554
Fort Bend	123,801	125,655	127,700	130,060	132,683	135,539	138,508	141,716	145,175	148,843	152,841
Galveston	73,748	74,970	76,071	76,694	77,930	79,322	80,766	82,327	84,022	85,875	87,861
Harris	691,020	700,621	710,716	718,772	730,832	743,387	756,411	771,459	785,757	803,103	818,735
Hidalgo	124,473	124,660	125,912	126,710	127,280	127,824	128,414	129,052	129,708	130,458	131,218
Johnson	31,468	31,800	32,026	32,269	32,561	32,875	33,216	33,590	33,991	34,429	34,902
Lubbock	73,877	74,427	74,940	75,475	76,154	76,875	77,645	78,466	79,362	80,339	81,374
McLennan	45,709	45,947	46,210	46,465	46,793	47,151	47,529	47,935	48,383	48,860	49,377
Montgomery	100,677	101,718	102,903	104,090	105,618	107,220	108,951	110,844	112,843	115,038	117,381
Tarrant	397,217	402,007	405,518	409,340	413,852	418,998	424,434	430,629	437,299	444,755	452,553
Travis	143,510	145,820	148,289	150,505	153,428	156,646	160,135	163,886	167,976	172,346	177,030
Williamson	88,780	90,042	91,258	92,425	93,946	95,622	97,405	99,363	101,515	103,811	106,308

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:											
	1/3	1/4	1/5	1/6	1/8			1/10			1/12					
Bexar	353,333	358,217	361,426	364,040	373,132	(74,626)	[17,910]	{8,955}	383,851	(76,770)	[18,425]	{9,212}	396,788	(79,358)	[19,046]	{9,523}
Brazoria	70,498	71,557	72,536	73,137	75,340	(15,068)	[3,616]	{1,808}	77,862	(15,572)	[3,737]	{1,869}	80,660	(16,132)	[3,872]	{1,936}
Brazos	42,894	43,358	43,877	44,709	46,306	(9,261)	[2,223]	{1,111}	48,244	(9,649)	[2,316]	{1,158}	50,617	(10,123)	[2,430]	{1,215}
Collin	146,810	148,998	150,533	152,472	156,916	(31,383)	[7,532]	{3,766}	162,150	(32,430)	[7,783]	{3,892}	168,396	(33,679)	[8,083]	{4,042}
Dallas	451,602	457,058	461,225	465,748	477,273	(95,455)	[22,909]	{11,455}	491,051	(98,210)	[23,570]	{11,785}	507,425	(101,485)	[24,356]	{12,178}
Denton	121,828	123,507	124,870	126,785	130,719	(26,144)	[6,274]	{3,137}	135,487	(27,097)	[6,503]	{3,252}	141,164	(28,233)	[6,776]	{3,388}
El Paso	169,708	170,476	171,237	172,015	173,441	(34,688)	[8,325]	{4,163}	175,021	(35,004)	[8,401]	{4,200}	176,819	(35,364)	[8,487]	{4,244}
Ellis	36,730	37,129	37,472	37,817	38,671	(7,734)	[1,856]	{928}	39,688	(7,938)	[1,905]	{953}	40,879	(8,176)	[1,962]	{981}
Fort Bend	123,801	125,655	127,700	130,060	135,539	(27,108)	[6,506]	{3,253}	141,716	(28,343)	[6,802]	{3,401}	148,843	(29,769)	[7,144]	{3,572}
Galveston	73,748	74,970	76,071	76,694	79,322	(15,864)	[3,807]	{1,904}	82,327	(16,465)	[3,952]	{1,976}	85,875	(17,175)	[4,122]	{2,061}
Harris	691,020	700,621	710,716	718,772	743,387	(148,677)	[35,683]	{17,841}	771,459	(154,292)	[37,030]	{18,515}	803,103	(160,621)	[38,549]	{19,274}
Hidalgo	124,473	124,660	125,912	126,710	127,824	(25,565)	[6,136]	{3,068}	129,052	(25,810)	[6,195]	{3,097}	130,458	(26,092)	[6,262]	{3,131}
Johnson	31,468	31,800	32,026	32,269	32,875	(6,575)	[1,578]	{789}	33,590	(6,718)	[1,612]	{806}	34,429	(6,886)	[1,653]	{826}
Lubbock	73,877	74,427	74,940	75,475	76,875	(15,375)	[3,690]	{1,845}	78,466	(15,693)	[3,766]	{1,883}	80,339	(16,068)	[3,856]	{1,928}
McLennan	45,709	45,947	46,210	46,465	47,151	(9,430)	[2,263]	{1,132}	47,935	(9,587)	[2,301]	{1,150}	48,860	(9,772)	[2,345]	{1,173}
Montgomery	100,677	101,718	102,903	104,090	107,220	(21,444)	[5,147]	{2,573}	110,844	(22,169)	[5,321]	{2,660}	115,038	(23,008)	[5,522]	{2,761}
Tarrant	397,217	402,007	405,518	409,340	418,998	(83,800)	[20,112]	{10,056}	430,629	(86,126)	[20,670]	{10,335}	444,755	(88,951)	[21,348]	{10,674}
Travis	143,510	145,820	148,289	150,505	156,646	(31,329)	[7,519]	{3,760}	163,886	(32,777)	[7,867]	{3,933}	172,346	(34,469)	[8,273]	{4,136}
Williamson	88,780	90,042	91,258	92,425	95,622	(19,124)	[4,590]	{2,295}	99,363	(19,873)	[4,769]	{2,385}	103,811	(20,762)	[4,983]	{2,491}

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.