

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

Date: 1/28/22

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 1/28/22 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.

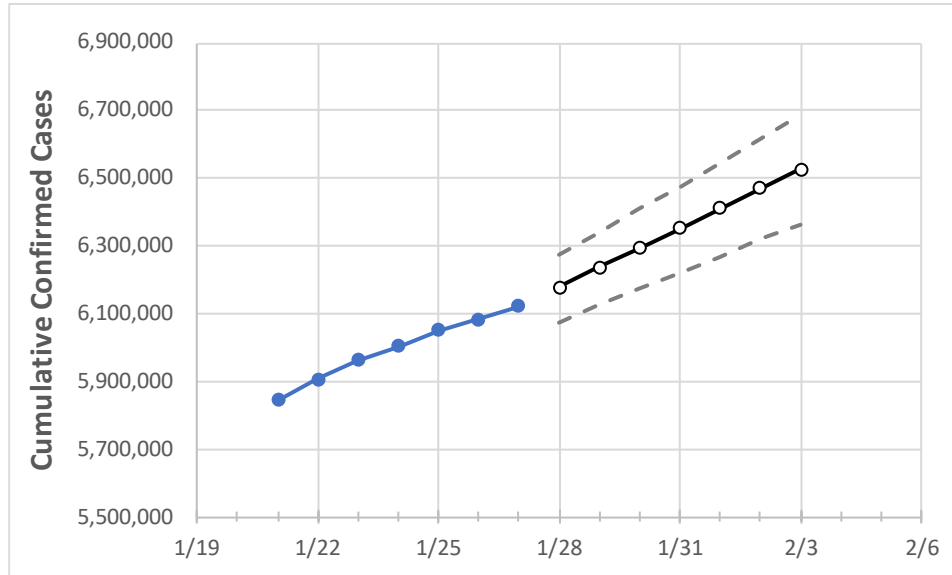
IEM's Modeling Lead

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:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3
Texas	6,004,502	6,050,828	6,083,164	6,121,818	6,179,245	6,237,712	6,294,709	6,353,325	6,412,426	6,469,901	6,527,586

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:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3
Bexar	475,960	481,807	486,729	491,290	498,037	504,868	511,809	518,651	525,648	532,628	540,029
Brazoria	86,225	86,639	86,956	87,288	87,747	88,171	88,596	89,014	89,424	89,818	90,217
Brazos	54,501	54,726	55,207	55,601	56,118	56,626	57,125	57,642	58,143	58,657	59,148
Collin	183,747	185,354	186,178	187,454	189,273	191,093	192,875	194,658	196,444	198,254	200,101
Dallas	526,319	529,249	530,879	533,154	537,116	541,008	544,760	548,616	552,280	556,249	560,099
Denton	154,269	155,602	157,735	158,688	160,486	162,229	164,023	165,753	167,551	169,349	171,195
El Paso	182,121	184,567	185,283	187,089	189,290	191,534	193,786	196,190	198,493	201,012	203,545
Ellis	44,704	45,002	45,181	45,431	45,830	46,227	46,613	47,005	47,394	47,794	48,192
Fort Bend	159,716	160,533	161,182	161,730	162,685	163,592	164,495	165,363	166,266	167,132	167,877
Galveston	87,846	88,274	88,636	89,067	89,545	90,003	90,460	90,878	91,323	91,746	92,154
Harris	928,497	932,770	936,534	939,380	944,774	949,728	954,504	959,591	964,359	969,151	973,707
Hidalgo	165,212	166,443	167,241	168,656	170,604	172,556	174,600	176,537	178,720	180,828	182,995
Johnson	38,475	38,773	38,905	39,165	39,495	39,823	40,153	40,478	40,808	41,126	41,462
Lubbock	86,686	87,425	87,850	88,264	89,358	90,510	91,601	92,776	93,934	95,101	96,344
McLennan	51,633	51,985	52,156	52,416	52,939	53,464	53,982	54,509	55,065	55,593	56,140
Montgomery	124,667	125,556	126,140	126,676	127,514	128,319	129,094	129,881	130,632	131,410	132,132
Tarrant	502,055	505,159	507,336	513,272	518,037	522,742	527,489	532,250	536,877	541,724	546,475
Travis	200,060	201,732	202,814	204,208	206,347	208,439	210,538	212,698	214,794	216,915	218,991
Williamson	116,531	118,260	119,058	120,291	121,764	123,273	124,776	126,252	127,835	129,424	130,925

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:											
	1/24	1/25	1/26	1/27	1/29		1/31		2/2							
Bexar	475,960	481,807	486,729	491,290	504,868	(100,974)	[24,234]	{12,117}	518,651	(103,730)	[24,895]	{12,448}	532,628	(106,526)	[25,566]	{12,783}
Brazoria	86,225	86,639	86,956	87,288	88,171	(17,634)	[4,232]	{2,116}	89,014	(17,803)	[4,273]	{2,136}	89,818	(17,964)	[4,311]	{2,156}
Brazos	54,501	54,726	55,207	55,601	56,626	(11,325)	[2,718]	{1,359}	57,642	(11,528)	[2,767]	{1,383}	58,657	(11,731)	[2,816]	{1,408}
Collin	183,747	185,354	186,178	187,454	191,093	(38,219)	[9,172]	{4,586}	194,658	(38,932)	[9,344]	{4,672}	198,254	(39,651)	[9,516]	{4,758}
Dallas	526,319	529,249	530,879	533,154	541,008	(108,202)	[25,968]	{12,984}	548,616	(109,723)	[26,334]	{13,167}	556,249	(111,250)	[26,700]	{13,350}
Denton	154,269	155,602	157,735	158,688	162,229	(32,446)	[7,787]	{3,893}	165,753	(33,151)	[7,956]	{3,978}	169,349	(33,870)	[8,129]	{4,064}
El Paso	182,121	184,567	185,283	187,089	191,534	(38,307)	[9,194]	{4,597}	196,190	(39,238)	[9,417]	{4,709}	201,012	(40,202)	[9,649]	{4,824}
Ellis	44,704	45,002	45,181	45,431	46,227	(9,245)	[2,219]	{1,109}	47,005	(9,401)	[2,256]	{1,128}	47,794	(9,559)	[2,294]	{1,147}
Fort Bend	159,716	160,533	161,182	161,730	163,592	(32,718)	[7,852]	{3,926}	165,363	(33,073)	[7,937]	{3,969}	167,132	(33,426)	[8,022]	{4,011}
Galveston	87,846	88,274	88,636	89,067	90,003	(18,001)	[4,320]	{2,160}	90,878	(18,176)	[4,362]	{2,181}	91,746	(18,349)	[4,404]	{2,202}
Harris	928,497	932,770	936,534	939,380	949,728	(189,946)	[45,587]	{22,793}	959,591	(191,918)	[46,060]	{23,030}	969,151	(193,830)	[46,519]	{23,260}
Hidalgo	165,212	166,443	167,241	168,656	172,556	(34,511)	[8,283]	{4,141}	176,537	(35,307)	[8,474]	{4,237}	180,828	(36,166)	[8,680]	{4,340}
Johnson	38,475	38,773	38,905	39,165	39,823	(7,965)	[1,911]	{956}	40,478	(8,096)	[1,943]	{971}	41,126	(8,225)	[1,974]	{987}
Lubbock	86,686	87,425	87,850	88,264	90,510	(18,102)	[4,344]	{2,172}	92,776	(18,555)	[4,453]	{2,227}	95,101	(19,020)	[4,565]	{2,282}
McLennan	51,633	51,985	52,156	52,416	53,464	(10,693)	[2,566]	{1,283}	54,509	(10,902)	[2,616]	{1,308}	55,593	(11,119)	[2,668]	{1,334}
Montgomery	124,667	125,556	126,140	126,676	128,319	(25,664)	[6,159]	{3,080}	129,881	(25,976)	[6,234]	{3,117}	131,410	(26,282)	[6,308]	{3,154}
Tarrant	502,055	505,159	507,336	513,272	522,742	(104,548)	[25,092]	{12,546}	532,250	(106,450)	[25,548]	{12,774}	541,724	(108,345)	[26,003]	{13,001}
Travis	200,060	201,732	202,814	204,208	208,439	(41,688)	[10,005]	{5,003}	212,698	(42,540)	[10,210]	{5,105}	216,915	(43,383)	[10,412]	{5,206}
Williamson	116,531	118,260	119,058	120,291	123,273	(24,655)	[5,917]	{2,959}	126,252	(25,250)	[6,060]	{3,030}	129,424	(25,885)	[6,212]	{3,106}

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.