

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

Date: 1/28/21

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 1/28/21 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.

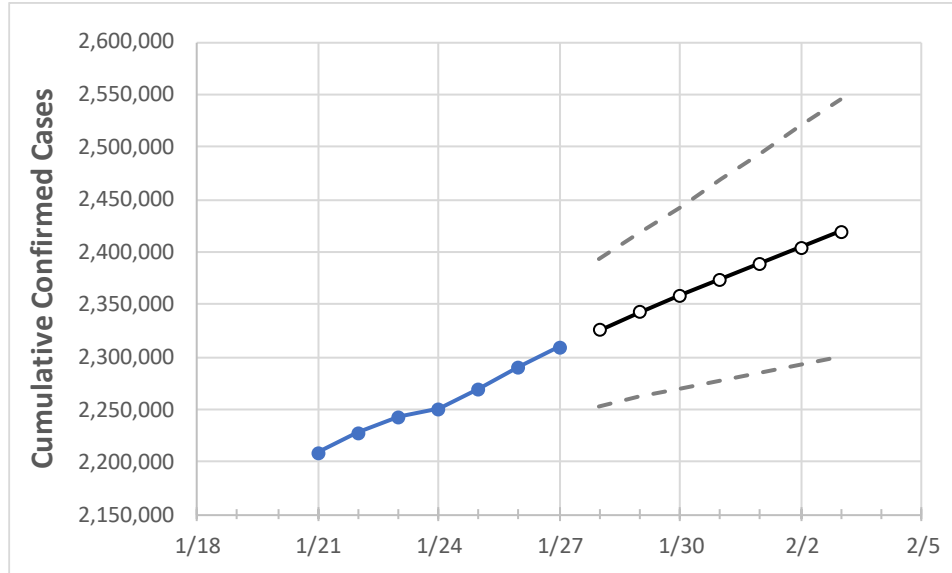
IEM's Modeling Lead

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:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3
Texas	2,250,421	2,269,424	2,290,621	2,309,220	2,325,509	2,342,243	2,358,208	2,373,567	2,389,387	2,404,270	2,419,459

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	160,026	162,108	162,929	164,270	165,825	167,368	168,833	170,350	171,867	173,269	174,715
Brazoria	27,581	27,639	27,779	28,087	28,281	28,475	28,663	28,849	29,034	29,215	29,386
Brazos	17,780	17,916	18,076	18,236	18,368	18,501	18,631	18,763	18,895	19,022	19,148
Collin	68,108	68,943	69,404	70,414	71,052	71,673	72,268	72,844	73,431	74,007	74,566
Dallas	246,820	248,518	250,376	252,047	253,559	255,040	256,482	257,937	259,358	260,772	262,124
Denton	50,128	50,439	51,212	51,857	52,390	52,924	53,448	53,985	54,525	55,081	55,651
El Paso	110,125	111,061	111,375	111,689	112,147	112,563	112,981	113,440	113,870	114,302	114,727
Ellis	17,747	17,896	18,046	18,139	18,273	18,401	18,528	18,651	18,768	18,882	18,996
Fort Bend	47,292	47,427	48,425	48,982	49,432	49,845	50,282	50,698	51,129	51,583	51,986
Galveston	28,878	29,099	29,319	29,485	29,737	29,978	30,225	30,456	30,688	30,911	31,134
Harris	297,629	301,173	304,333	306,495	308,627	310,739	312,683	314,749	316,717	318,593	320,476
Hidalgo	60,718	60,971	61,595	62,249	62,693	63,158	63,623	64,084	64,575	65,056	65,557
Johnson	15,710	15,806	15,901	16,021	16,124	16,219	16,313	16,403	16,491	16,577	16,660
Lubbock	46,163	46,241	46,329	46,452	46,537	46,618	46,693	46,767	46,838	46,904	46,968
McLennan	22,657	22,729	22,801	22,846	22,912	22,974	23,034	23,086	23,139	23,186	23,232
Montgomery	36,056	36,344	38,075	38,557	39,134	39,724	40,328	40,954	41,599	42,274	42,964
Tarrant	205,329	208,325	209,849	211,076	212,842	214,528	216,243	217,952	219,574	221,144	222,682
Travis	64,963	65,507	66,209	66,859	67,389	67,930	68,444	68,952	69,479	69,997	70,488
Williamson	33,528	33,818	34,263	34,746	35,145	35,531	35,920	36,302	36,679	37,049	37,426

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	160,026	162,108	162,929	164,270	167,368	(33,474)	[8,034]	{4,017}	170,350	(34,070)	[8,177]	{4,088}	173,269	(34,654)	[8,317]	{4,158}
Brazoria	27,581	27,639	27,779	28,087	28,475	(5,695)	[1,367]	{683}	28,849	(5,770)	[1,385]	{692}	29,215	(5,843)	[1,402]	{701}
Brazos	17,780	17,916	18,076	18,236	18,501	(3,700)	[888]	{444}	18,763	(3,753)	[901]	{450}	19,022	(3,804)	[913]	{457}
Collin	68,108	68,943	69,404	70,414	71,673	(14,335)	[3,440]	{1,720}	72,844	(14,569)	[3,496]	{1,748}	74,007	(14,801)	[3,552]	{1,776}
Dallas	246,820	248,518	250,376	252,047	255,040	(51,008)	[12,242]	{6,121}	257,937	(51,587)	[12,381]	{6,190}	260,772	(52,154)	[12,517]	{6,259}
Denton	50,128	50,439	51,212	51,857	52,924	(10,585)	[2,540]	{1,270}	53,985	(10,797)	[2,591]	{1,296}	55,081	(11,016)	[2,644]	{1,322}
El Paso	110,125	111,061	111,375	111,689	112,563	(22,513)	[5,403]	{2,702}	113,440	(22,688)	[5,445]	{2,723}	114,302	(22,860)	[5,487]	{2,743}
Ellis	17,747	17,896	18,046	18,139	18,401	(3,680)	[883]	{442}	18,651	(3,730)	[895]	{448}	18,882	(3,776)	[906]	{453}
Fort Bend	47,292	47,427	48,425	48,982	49,845	(9,969)	[2,393]	{1,196}	50,698	(10,140)	[2,433]	{1,217}	51,583	(10,317)	[2,476]	{1,238}
Galveston	28,878	29,099	29,319	29,485	29,978	(5,996)	[1,439]	{719}	30,456	(6,091)	[1,462]	{731}	30,911	(6,182)	[1,484]	{742}
Harris	297,629	301,173	304,333	306,495	310,739	(62,148)	[14,915]	{7,458}	314,749	(62,950)	[15,108]	{7,554}	318,593	(63,719)	[15,292]	{7,646}
Hidalgo	60,718	60,971	61,595	62,249	63,158	(12,632)	[3,032]	{1,516}	64,084	(12,817)	[3,076]	{1,538}	65,056	(13,011)	[3,123]	{1,561}
Johnson	15,710	15,806	15,901	16,021	16,219	(3,244)	[779]	{389}	16,403	(3,281)	[787]	{394}	16,577	(3,315)	[796]	{398}
Lubbock	46,163	46,241	46,329	46,452	46,618	(9,324)	[2,238]	{1,119}	46,767	(9,353)	[2,245]	{1,122}	46,904	(9,381)	[2,251]	{1,126}
McLennan	22,657	22,729	22,801	22,846	22,974	(4,595)	[1,103]	{551}	23,086	(4,617)	[1,108]	{554}	23,186	(4,637)	[1,113]	{556}
Montgomery	36,056	36,344	38,075	38,557	39,724	(7,945)	[1,907]	{953}	40,954	(8,191)	[1,966]	{983}	42,274	(8,455)	[2,029]	{1,015}
Tarrant	205,329	208,325	209,849	211,076	214,528	(42,906)	[10,297]	{5,149}	217,952	(43,590)	[10,462]	{5,231}	221,144	(44,229)	[10,615]	{5,307}
Travis	64,963	65,507	66,209	66,859	67,930	(13,586)	[3,261]	{1,630}	68,952	(13,790)	[3,310]	{1,655}	69,997	(13,999)	[3,360]	{1,680}
Williamson	33,528	33,818	34,263	34,746	35,531	(7,106)	[1,705]	{853}	36,302	(7,260)	[1,743]	{871}	37,049	(7,410)	[1,778]	{889}

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.