

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

Date: 2/14/22

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 2/14/22 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.

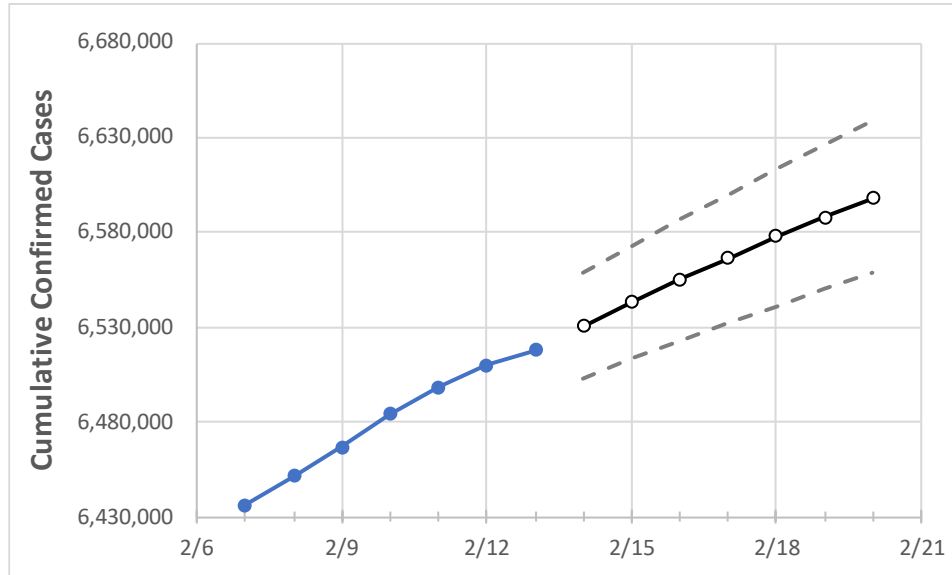
IEM's Modeling Lead

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:						
	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20
Texas	6,484,110	6,498,479	6,509,857	6,517,733	6,530,660	6,543,290	6,555,439	6,566,651	6,577,793	6,588,060	6,598,054

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:						
	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20
Bexar	531,989	533,360	534,398	535,320	536,635	537,995	539,193	540,328	541,390	542,549	543,484
Brazoria	91,226	91,411	91,583	91,700	91,862	92,019	92,177	92,319	92,460	92,599	92,726
Brazos	58,858	58,964	59,047	59,092	59,203	59,309	59,406	59,493	59,586	59,668	59,760
Collin	199,019	199,543	199,991	200,208	200,630	201,045	201,428	201,798	202,147	202,482	202,819
Dallas	557,007	557,614	559,449	560,219	561,045	561,797	562,519	563,233	563,916	564,563	565,173
Denton	171,885	172,547	172,547	172,547	173,341	173,973	174,750	175,342	176,135	176,846	177,472
El Paso	200,199	200,626	201,027	201,229	201,651	202,030	202,408	202,752	203,091	203,406	203,743
Ellis	47,406	47,500	47,573	47,624	47,691	47,755	47,814	47,871	47,925	47,979	48,028
Fort Bend	170,783	171,250	171,645	171,931	172,316	172,701	173,057	173,411	173,757	174,075	174,391
Galveston	92,957	93,106	93,568	93,691	93,881	94,067	94,255	94,427	94,592	94,771	94,921
Harris	975,762	977,268	978,751	979,981	981,354	982,640	983,847	985,029	986,183	987,244	988,317
Hidalgo	183,396	183,902	184,443	185,582	186,314	187,064	187,681	188,333	188,926	189,593	190,180
Johnson	40,989	41,093	41,168	41,211	41,280	41,348	41,405	41,464	41,523	41,580	41,628
Lubbock	92,194	92,371	92,466	92,511	92,613	92,721	92,808	92,892	92,980	93,055	93,124
McLennan	54,650	54,732	54,785	54,838	54,905	54,974	55,028	55,085	55,143	55,195	55,244
Montgomery	132,763	132,996	133,207	133,377	133,606	133,817	134,018	134,208	134,393	134,571	134,729
Tarrant	548,922	550,063	550,063	550,063	551,689	553,337	554,944	556,327	557,928	559,363	560,626
Travis	215,601	216,064	216,360	216,611	216,965	217,301	217,623	217,913	218,199	218,479	218,731
Williamson	128,570	128,969	128,969	128,969	129,389	129,795	130,212	130,616	130,953	131,368	131,678

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:											
	2/10	2/11	2/12	2/13	2/15				2/17				2/19			
Bexar	531,989	533,360	534,398	535,320	537,995	(107,599)	[25,824]	{12,912}	540,328	(108,066)	[25,936]	{12,968}	542,549	(108,510)	[26,042]	{13,021}
Brazoria	91,226	91,411	91,583	91,700	92,019	(18,404)	[4,417]	{2,208}	92,319	(18,464)	[4,431]	{2,216}	92,599	(18,520)	[4,445]	{2,222}
Brazos	58,858	58,964	59,047	59,092	59,309	(11,862)	[2,847]	{1,423}	59,493	(11,899)	[2,856]	{1,428}	59,668	(11,934)	[2,864]	{1,432}
Collin	199,019	199,543	199,991	200,208	201,045	(40,209)	[9,650]	{4,825}	201,798	(40,360)	[9,686]	{4,843}	202,482	(40,496)	[9,719]	{4,860}
Dallas	557,007	557,614	559,449	560,219	561,797	(112,359)	[26,966]	{13,483}	563,233	(112,647)	[27,035]	{13,518}	564,563	(112,913)	[27,099]	{13,550}
Denton	171,885	172,547	172,547	172,547	173,973	(34,795)	[8,351]	{4,175}	175,342	(35,068)	[8,416]	{4,208}	176,846	(35,369)	[8,489]	{4,244}
El Paso	200,199	200,626	201,027	201,229	202,030	(40,406)	[9,697]	{4,849}	202,752	(40,550)	[9,732]	{4,866}	203,406	(40,681)	[9,763]	{4,882}
Ellis	47,406	47,500	47,573	47,624	47,755	(9,551)	[2,292]	{1,146}	47,871	(9,574)	[2,298]	{1,149}	47,979	(9,596)	[2,303]	{1,151}
Fort Bend	170,783	171,250	171,645	171,931	172,701	(34,540)	[8,290]	{4,145}	173,411	(34,682)	[8,324]	{4,162}	174,075	(34,815)	[8,356]	{4,178}
Galveston	92,957	93,106	93,568	93,691	94,067	(18,813)	[4,515]	{2,258}	94,427	(18,885)	[4,532]	{2,266}	94,771	(18,954)	[4,549]	{2,275}
Harris	975,762	977,268	978,751	979,981	982,640	(196,528)	[47,167]	{23,583}	985,029	(197,006)	[47,281]	{23,641}	987,244	(197,449)	[47,388]	{23,694}
Hidalgo	183,396	183,902	184,443	185,582	187,064	(37,413)	[8,979]	{4,490}	188,333	(37,667)	[9,040]	{4,520}	189,593	(37,919)	[9,100]	{4,550}
Johnson	40,989	41,093	41,168	41,211	41,348	(8,270)	[1,985]	{992}	41,464	(8,293)	[1,990]	{995}	41,580	(8,316)	[1,996]	{998}
Lubbock	92,194	92,371	92,466	92,511	92,721	(18,544)	[4,451]	{2,225}	92,892	(18,578)	[4,459]	{2,229}	93,055	(18,611)	[4,467]	{2,233}
McLennan	54,650	54,732	54,785	54,838	54,974	(10,995)	[2,639]	{1,319}	55,085	(11,017)	[2,644]	{1,322}	55,195	(11,039)	[2,649]	{1,325}
Montgomery	132,763	132,996	133,207	133,377	133,817	(26,763)	[6,423]	{3,212}	134,208	(26,842)	[6,442]	{3,221}	134,571	(26,914)	[6,459]	{3,230}
Tarrant	548,922	550,063	550,063	550,063	553,337	(110,667)	[26,560]	{13,280}	556,327	(111,265)	[26,704]	{13,352}	559,363	(111,873)	[26,849]	{13,425}
Travis	215,601	216,064	216,360	216,611	217,301	(43,460)	[10,430]	{5,215}	217,913	(43,583)	[10,460]	{5,230}	218,479	(43,696)	[10,487]	{5,243}
Williamson	128,570	128,969	128,969	128,969	129,795	(25,959)	[6,230]	{3,115}	130,616	(26,123)	[6,270]	{3,135}	131,368	(26,274)	[6,306]	{3,153}

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.