

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 2/23/21**

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 2/23/21 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.

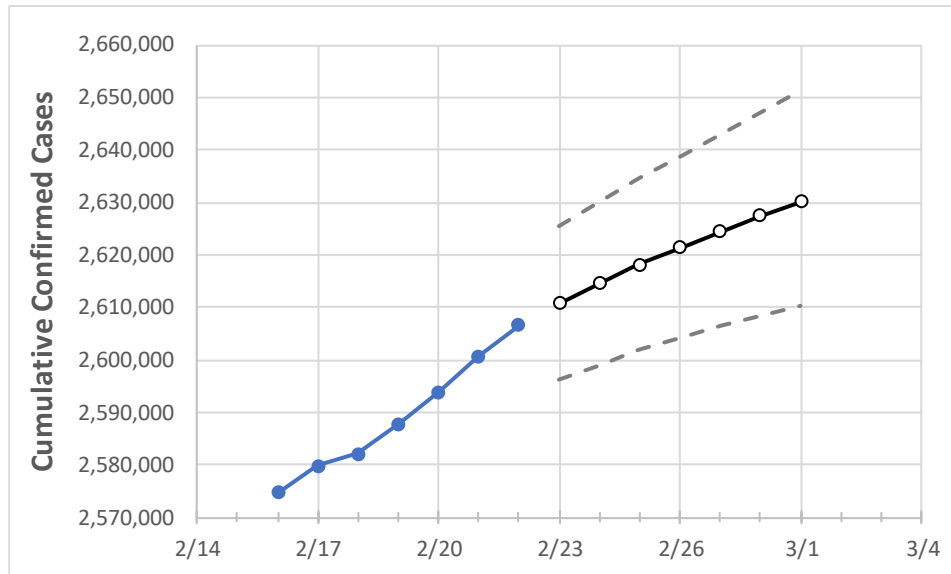
IEM's Modeling Lead

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Texas	2,587,712	2,593,816	2,600,660	2,606,513	2,610,690	2,614,583	2,618,192	2,621,457	2,624,468	2,627,381	2,630,143

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Bexar	189,646	189,963	193,461	193,691	194,231	194,776	195,302	195,806	196,288	196,763	197,219
Brazoria	31,331	31,368	31,704	31,684	31,774	31,861	31,948	32,029	32,107	32,187	32,263
Brazos	20,282	20,307	20,331	20,441	20,473	20,505	20,535	20,563	20,587	20,611	20,632
Collin	81,062	81,130	81,208	81,392	81,585	81,767	81,932	82,093	82,243	82,392	82,534
Dallas	276,339	276,672	276,945	276,945	277,300	277,628	277,926	278,197	278,456	278,690	278,908
Denton	60,826	60,936	61,046	61,156	61,343	61,521	61,686	61,868	62,029	62,198	62,345
El Paso	120,769	120,982	121,503	121,765	122,056	122,333	122,609	122,873	123,136	123,398	123,652
Ellis	20,381	20,406	20,406	20,406	20,444	20,478	20,511	20,542	20,571	20,598	20,622
Fort Bend	55,548	56,104	56,435	56,765	56,942	57,113	57,269	57,426	57,585	57,728	57,862
Galveston	33,525	33,562	33,666	33,666	33,741	33,811	33,876	33,939	33,996	34,055	34,111
Harris	340,559	340,951	342,309	343,070	343,725	344,392	345,002	345,614	346,222	346,777	347,286
Hidalgo	72,723	72,957	73,191	73,425	73,682	73,937	74,189	74,423	74,654	74,872	75,089
Johnson	18,188	18,227	18,227	18,227	18,273	18,317	18,358	18,399	18,437	18,473	18,511
Lubbock	47,905	47,954	47,976	47,984	48,010	48,035	48,057	48,078	48,099	48,119	48,139
McLennan	24,268	24,268	24,268	24,268	24,328	24,389	24,450	24,511	24,567	24,625	24,686
Montgomery	44,060	44,155	44,251	44,346	44,458	44,564	44,665	44,765	44,858	44,944	45,026
Tarrant	237,676	238,077	238,449	238,820	239,215	239,599	239,959	240,296	240,614	240,918	241,199
Travis	73,749	73,779	73,809	74,206	74,279	74,350	74,413	74,474	74,530	74,580	74,630
Williamson	39,586	39,586	39,586	39,586	39,817	40,040	40,255	40,477	40,691	40,908	41,118

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:											
	2/19	2/20	2/21	2/22	2/24			2/26			2/28					
Bexar	189,646	189,963	193,461	193,691	194,776	(38,955)	[9,349]	{4,675}	195,806	(39,161)	[9,399]	{4,699}	196,763	(39,353)	[9,445]	{4,722}
Brazoria	31,331	31,368	31,704	31,684	31,861	(6,372)	[1,529]	{765}	32,029	(6,406)	[1,537]	{769}	32,187	(6,437)	[1,545]	{772}
Brazos	20,282	20,307	20,331	20,441	20,505	(4,101)	[984]	{492}	20,563	(4,113)	[987]	{494}	20,611	(4,122)	[989]	{495}
Collin	81,062	81,130	81,208	81,392	81,767	(16,353)	[3,925]	{1,962}	82,093	(16,419)	[3,940]	{1,970}	82,392	(16,478)	[3,955]	{1,977}
Dallas	276,339	276,672	276,945	276,945	277,628	(55,526)	[13,326]	{6,663}	278,197	(55,639)	[13,353]	{6,677}	278,690	(55,738)	[13,377]	{6,689}
Denton	60,826	60,936	61,046	61,156	61,521	(12,304)	[2,953]	{1,477}	61,868	(12,374)	[2,970]	{1,485}	62,198	(12,440)	[2,985]	{1,493}
El Paso	120,769	120,982	121,503	121,765	122,333	(24,467)	[5,872]	{2,936}	122,873	(24,575)	[5,898]	{2,949}	123,398	(24,680)	[5,923]	{2,962}
Ellis	20,381	20,406	20,406	20,406	20,478	(4,096)	[983]	{491}	20,542	(4,108)	[986]	{493}	20,598	(4,120)	[989]	{494}
Fort Bend	55,548	56,104	56,435	56,765	57,113	(11,423)	[2,741]	{1,371}	57,426	(11,485)	[2,756]	{1,378}	57,728	(11,546)	[2,771]	{1,385}
Galveston	33,525	33,562	33,666	33,666	33,811	(6,762)	[1,623]	{811}	33,939	(6,788)	[1,629]	{815}	34,055	(6,811)	[1,635]	{817}
Harris	340,559	340,951	342,309	343,070	344,392	(68,878)	[16,531]	{8,265}	345,614	(69,123)	[16,589]	{8,295}	346,777	(69,355)	[16,645]	{8,323}
Hidalgo	72,723	72,957	73,191	73,425	73,937	(14,787)	[3,549]	{1,774}	74,423	(14,885)	[3,572]	{1,786}	74,872	(14,974)	[3,594]	{1,797}
Johnson	18,188	18,227	18,227	18,227	18,317	(3,663)	[879]	{440}	18,399	(3,680)	[883]	{442}	18,473	(3,695)	[887]	{443}
Lubbock	47,905	47,954	47,976	47,984	48,035	(9,607)	[2,306]	{1,153}	48,078	(9,616)	[2,308]	{1,154}	48,119	(9,624)	[2,310]	{1,155}
McLennan	24,268	24,268	24,268	24,268	24,389	(4,878)	[1,171]	{585}	24,511	(4,902)	[1,177]	{588}	24,625	(4,925)	[1,182]	{591}
Montgomery	44,060	44,155	44,251	44,346	44,564	(8,913)	[2,139]	{1,070}	44,765	(8,953)	[2,149]	{1,074}	44,944	(8,989)	[2,157]	{1,079}
Tarrant	237,676	238,077	238,449	238,820	239,599	(47,920)	[11,501]	{5,750}	240,296	(48,059)	[11,534]	{5,767}	240,918	(48,184)	[11,564]	{5,782}
Travis	73,749	73,779	73,809	74,206	74,350	(14,870)	[3,569]	{1,784}	74,474	(14,895)	[3,575]	{1,787}	74,580	(14,916)	[3,580]	{1,790}
Williamson	39,586	39,586	39,586	39,586	40,040	(8,008)	[1,922]	{961}	40,477	(8,095)	[1,943]	{971}	40,908	(8,182)	[1,964]	{982}

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.