

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

Date: 3/24/21

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 3/24/21 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.

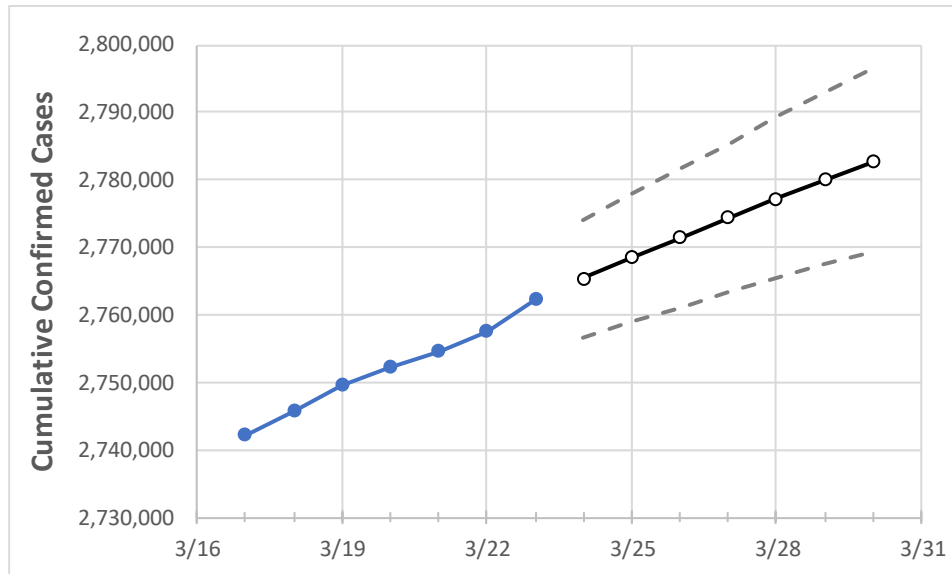
IEM's Modeling Lead

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:						
	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30
Texas	2,752,279	2,754,616	2,757,552	2,762,270	2,765,404	2,768,468	2,771,486	2,774,417	2,777,220	2,779,968	2,782,646

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:							
	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	
Bexar	201,692	202,550	202,716	202,849	203,082	203,307	203,546	203,758	203,993	204,208	204,412	
Brazoria	34,691	34,803	34,891	34,979	35,051	35,122	35,195	35,262	35,329	35,393	35,457	
Brazos	22,484	22,511	22,538	22,582	22,642	22,701	22,759	22,815	22,870	22,927	22,981	
Collin	85,601	85,651	85,702	85,885	85,964	86,044	86,119	86,193	86,262	86,331	86,398	
Dallas	288,216	288,458	288,700	288,928	289,135	289,327	289,513	289,690	289,857	290,023	290,185	
Denton	70,947	71,009	71,071	71,200	71,327	71,447	71,558	71,667	71,763	71,856	71,948	
El Paso	127,824	127,992	128,119	128,252	128,391	128,521	128,651	128,779	128,904	129,020	129,139	
Ellis	21,650	21,664	21,677	21,691	21,701	21,711	21,719	21,727	21,734	21,740	21,747	
Fort Bend	61,956	61,991	62,025	62,354	62,489	62,632	62,764	62,902	63,033	63,169	63,297	
Galveston	36,383	36,465	36,512	36,559	36,621	36,679	36,736	36,793	36,845	36,897	36,948	
Harris	369,613	370,223	370,459	371,161	371,727	372,294	372,827	373,362	373,869	374,384	374,860	
Hidalgo	83,444	83,488	83,531	83,714	83,961	84,228	84,465	84,706	84,939	85,164	85,419	
Johnson	19,078	19,093	19,108	19,123	19,140	19,156	19,172	19,187	19,201	19,215	19,228	
Lubbock	48,433	48,441	48,449	48,457	48,467	48,477	48,486	48,495	48,504	48,511	48,520	
McLennan	25,747	25,780	25,813	25,846	25,872	25,897	25,921	25,946	25,970	25,994	26,017	
Montgomery	48,161	48,258	48,355	48,506	48,625	48,742	48,855	48,973	49,084	49,194	49,307	
Tarrant	248,677	248,748	249,150	249,418	249,617	249,810	249,997	250,174	250,349	250,511	250,671	
Travis	78,108	78,193	78,308	78,372	78,457	78,534	78,613	78,693	78,770	78,840	78,908	
Williamson	42,375	42,424	42,473	42,627	42,692	42,755	42,819	42,884	42,947	43,008	43,071	

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:											
	3/20	3/21	3/22	3/23	3/25			3/27			3/29					
Bexar	201,692	202,550	202,716	202,849	203,307	(40,661)	[9,759]	{4,879}	203,758	(40,752)	[9,780]	{4,890}	204,208	(40,842)	[9,802]	{4,901}
Brazoria	34,691	34,803	34,891	34,979	35,122	(7,024)	[1,686]	{843}	35,262	(7,052)	[1,693]	{846}	35,393	(7,079)	[1,699]	{849}
Brazos	22,484	22,511	22,538	22,582	22,701	(4,540)	[1,090]	{545}	22,815	(4,563)	[1,095]	{548}	22,927	(4,585)	[1,100]	{550}
Collin	85,601	85,651	85,702	85,885	86,044	(17,209)	[4,130]	{2,065}	86,193	(17,239)	[4,137]	{2,069}	86,331	(17,266)	[4,144]	{2,072}
Dallas	288,216	288,458	288,700	288,928	289,327	(57,865)	[13,888]	{6,944}	289,690	(57,938)	[13,905]	{6,953}	290,023	(58,005)	[13,921]	{6,961}
Denton	70,947	71,009	71,071	71,200	71,447	(14,289)	[3,429]	{1,715}	71,667	(14,333)	[3,440]	{1,720}	71,856	(14,371)	[3,449]	{1,725}
El Paso	127,824	127,992	128,119	128,252	128,521	(25,704)	[6,169]	{3,084}	128,779	(25,756)	[6,181]	{3,091}	129,020	(25,804)	[6,193]	{3,096}
Ellis	21,650	21,664	21,677	21,691	21,711	(4,342)	[1,042]	{521}	21,727	(4,345)	[1,043]	{521}	21,740	(4,348)	[1,044]	{522}
Fort Bend	61,956	61,991	62,025	62,354	62,632	(12,526)	[3,006]	{1,503}	62,902	(12,580)	[3,019]	{1,510}	63,169	(12,634)	[3,032]	{1,516}
Galveston	36,383	36,465	36,512	36,559	36,679	(7,336)	[1,761]	{880}	36,793	(7,359)	[1,766]	{883}	36,897	(7,379)	[1,771]	{886}
Harris	369,613	370,223	370,459	371,161	372,294	(74,459)	[17,870]	{8,935}	373,362	(74,672)	[17,921]	{8,961}	374,384	(74,877)	[17,970]	{8,985}
Hidalgo	83,444	83,488	83,531	83,714	84,228	(16,846)	[4,043]	{2,021}	84,706	(16,941)	[4,066]	{2,033}	85,164	(17,033)	[4,088]	{2,044}
Johnson	19,078	19,093	19,108	19,123	19,156	(3,831)	[920]	{460}	19,187	(3,837)	[921]	{460}	19,215	(3,843)	[922]	{461}
Lubbock	48,433	48,441	48,449	48,457	48,477	(9,695)	[2,327]	{1,163}	48,495	(9,699)	[2,328]	{1,164}	48,511	(9,702)	[2,329]	{1,164}
McLennan	25,747	25,780	25,813	25,846	25,897	(5,179)	[1,243]	{622}	25,946	(5,189)	[1,245]	{623}	25,994	(5,199)	[1,248]	{624}
Montgomery	48,161	48,258	48,355	48,506	48,742	(9,748)	[2,340]	{1,170}	48,973	(9,795)	[2,351]	{1,175}	49,194	(9,839)	[2,361]	{1,181}
Tarrant	248,677	248,748	249,150	249,418	249,810	(49,962)	[11,991]	{5,995}	250,174	(50,035)	[12,008]	{6,004}	250,511	(50,102)	[12,025]	{6,012}
Travis	78,108	78,193	78,308	78,372	78,534	(15,707)	[3,770]	{1,885}	78,693	(15,739)	[3,777]	{1,889}	78,840	(15,768)	[3,784]	{1,892}
Williamson	42,375	42,424	42,473	42,627	42,755	(8,551)	[2,052]	{1,026}	42,884	(8,577)	[2,058]	{1,029}	43,008	(8,602)	[2,064]	{1,032}

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.