

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

Date: 3/22/21

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 3/22/21 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.

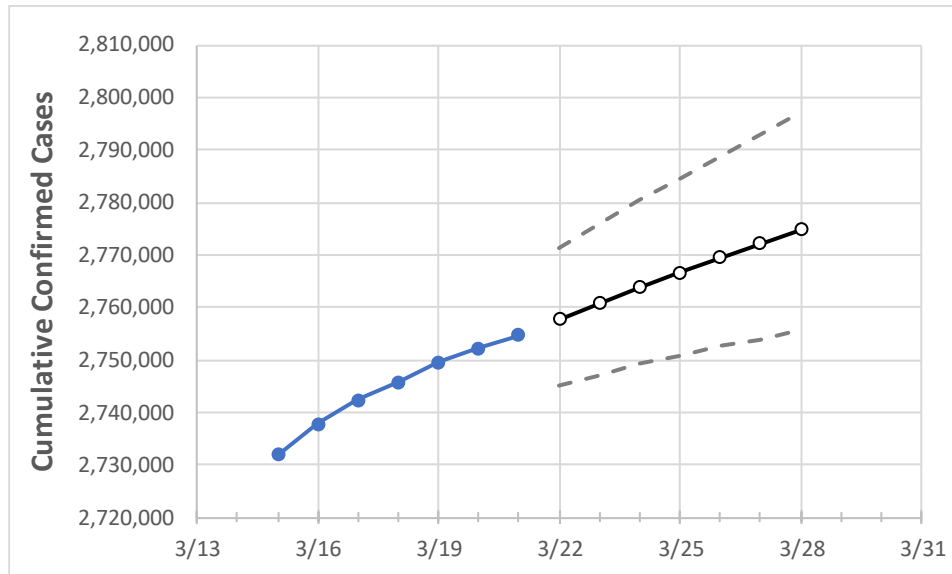
IEM's Modeling Lead

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:							
	3/18	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	

Texas 2,745,694 2,749,624 2,752,279 2,754,616 2,757,786 2,760,839 2,763,754 2,766,630 2,769,450 2,772,213 2,774,779

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:							
	3/18	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	
Bexar	201,273	201,411	201,692	202,550	202,818	203,086	203,359	203,634	203,910	204,179	204,443	
Brazoria	34,584	34,629	34,691	34,803	34,872	34,938	35,003	35,069	35,133	35,194	35,255	
Brazos	22,367	22,457	22,457	22,457	22,535	22,615	22,693	22,774	22,856	22,936	23,018	
Collin	85,511	85,550	85,550	85,550	85,645	85,729	85,811	85,896	85,979	86,064	86,143	
Dallas	287,641	287,989	288,216	288,216	288,431	288,636	288,833	289,020	289,205	289,385	289,560	
Denton	70,771	70,885	70,885	70,885	71,070	71,242	71,413	71,578	71,728	71,876	72,016	
El Paso	127,538	127,661	127,824	127,992	128,148	128,300	128,449	128,596	128,738	128,877	129,009	
Ellis	21,610	21,626	21,650	21,650	21,660	21,670	21,679	21,688	21,695	21,702	21,708	
Fort Bend	61,559	61,922	61,922	61,922	62,103	62,274	62,444	62,614	62,789	62,958	63,139	
Galveston	36,239	36,323	36,383	36,465	36,530	36,592	36,656	36,716	36,775	36,832	36,888	
Harris	368,213	368,908	369,613	370,223	370,792	371,369	371,937	372,504	373,029	373,560	374,070	
Hidalgo	83,259	83,401	83,401	83,401	83,814	84,241	84,682	85,147	85,596	86,085	86,588	
Johnson	19,026	19,044	19,078	19,078	19,095	19,112	19,127	19,143	19,158	19,173	19,187	
Lubbock	48,414	48,424	48,433	48,433	48,445	48,456	48,468	48,479	48,490	48,501	48,511	
McLennan	25,678	25,713	25,747	25,747	25,772	25,797	25,820	25,843	25,865	25,888	25,909	
Montgomery	47,834	48,064	48,064	48,064	48,188	48,309	48,431	48,551	48,669	48,787	48,905	
Tarrant	248,317	248,606	248,677	248,748	248,930	249,100	249,265	249,432	249,589	249,740	249,883	
Travis	77,916	78,011	78,108	78,193	78,284	78,376	78,465	78,547	78,628	78,705	78,784	
Williamson	42,259	42,326	42,326	42,326	42,389	42,452	42,515	42,579	42,643	42,707	42,767	

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:											
	3/18	3/19	3/20	3/21	3/23				3/25				3/27			
Bexar	201,273	201,411	201,692	202,550	203,086	(40,617)	[9,748]	{4,874}	203,634	(40,727)	[9,774]	{4,887}	204,179	(40,836)	[9,801]	{4,900}
Brazoria	34,584	34,629	34,691	34,803	34,938	(6,988)	[1,677]	{839}	35,069	(7,014)	[1,683]	{842}	35,194	(7,039)	[1,689]	{845}
Brazos	22,367	22,457	22,457	22,457	22,615	(4,523)	[1,086]	{543}	22,774	(4,555)	[1,093]	{547}	22,936	(4,587)	[1,101]	{550}
Collin	85,511	85,550	85,550	85,550	85,729	(17,146)	[4,115]	{2,057}	85,896	(17,179)	[4,123]	{2,062}	86,064	(17,213)	[4,131]	{2,066}
Dallas	287,641	287,989	288,216	288,216	288,636	(57,727)	[13,855]	{6,927}	289,020	(57,804)	[13,873]	{6,936}	289,385	(57,877)	[13,890]	{6,945}
Denton	70,771	70,885	70,885	70,885	71,242	(14,248)	[3,420]	{1,710}	71,578	(14,316)	[3,436]	{1,718}	71,876	(14,375)	[3,450]	{1,725}
El Paso	127,538	127,661	127,824	127,992	128,300	(25,660)	[6,158]	{3,079}	128,596	(25,719)	[6,173]	{3,086}	128,877	(25,775)	[6,186]	{3,093}
Ellis	21,610	21,626	21,650	21,650	21,670	(4,334)	[1,040]	{520}	21,688	(4,338)	[1,041]	{521}	21,702	(4,340)	[1,042]	{521}
Fort Bend	61,559	61,922	61,922	61,922	62,274	(12,455)	[2,989]	{1,495}	62,614	(12,523)	[3,005]	{1,503}	62,958	(12,592)	[3,022]	{1,511}
Galveston	36,239	36,323	36,383	36,465	36,592	(7,318)	[1,756]	{878}	36,716	(7,343)	[1,762]	{881}	36,832	(7,366)	[1,768]	{884}
Harris	368,213	368,908	369,613	370,223	371,369	(74,274)	[17,826]	{8,913}	372,504	(74,501)	[17,880]	{8,940}	373,560	(74,712)	[17,931]	{8,965}
Hidalgo	83,259	83,401	83,401	83,401	84,241	(16,848)	[4,044]	{2,022}	85,147	(17,029)	[4,087]	{2,044}	86,085	(17,217)	[4,132]	{2,066}
Johnson	19,026	19,044	19,078	19,078	19,112	(3,822)	[917]	{459}	19,143	(3,829)	[919]	{459}	19,173	(3,835)	[920]	{460}
Lubbock	48,414	48,424	48,433	48,433	48,456	(9,691)	[2,326]	{1,163}	48,479	(9,696)	[2,327]	{1,163}	48,501	(9,700)	[2,328]	{1,164}
McLennan	25,678	25,713	25,747	25,747	25,797	(5,159)	[1,238]	{619}	25,843	(5,169)	[1,240]	{620}	25,888	(5,178)	[1,243]	{621}
Montgomery	47,834	48,064	48,064	48,064	48,309	(9,662)	[2,319]	{1,159}	48,551	(9,710)	[2,330]	{1,165}	48,787	(9,757)	[2,342]	{1,171}
Tarrant	248,317	248,606	248,677	248,748	249,100	(49,820)	[11,957]	{5,978}	249,432	(49,886)	[11,973]	{5,986}	249,740	(49,948)	[11,988]	{5,994}
Travis	77,916	78,011	78,108	78,193	78,376	(15,675)	[3,762]	{1,881}	78,547	(15,709)	[3,770]	{1,885}	78,705	(15,741)	[3,778]	{1,889}
Williamson	42,259	42,326	42,326	42,326	42,452	(8,490)	[2,038]	{1,019}	42,579	(8,516)	[2,044]	{1,022}	42,707	(8,541)	[2,050]	{1,025}

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.