

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

Date: 3/23/21

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 3/23/21 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.

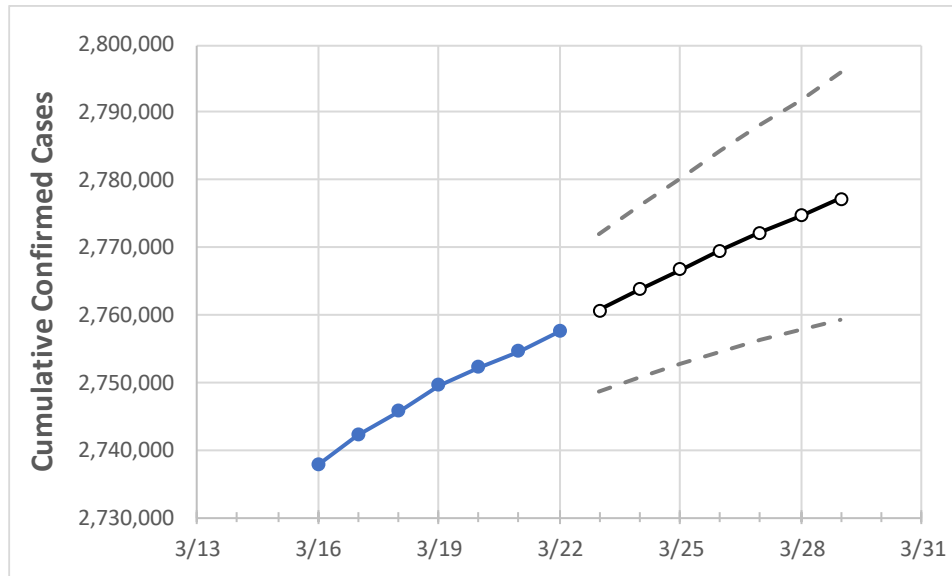
IEM's Modeling Lead

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:						
	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29
Texas	2,749,624	2,752,279	2,754,616	2,757,552	2,760,677	2,763,739	2,766,685	2,769,477	2,772,151	2,774,761	2,777,254

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:						
	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29
Bexar	201,411	201,692	202,550	202,716	202,952	203,181	203,425	203,667	203,878	204,101	204,321
Brazoria	34,629	34,691	34,803	34,803	34,868	34,933	34,996	35,059	35,120	35,177	35,231
Brazos	22,457	22,484	22,511	22,538	22,600	22,659	22,720	22,781	22,841	22,902	22,959
Collin	85,550	85,601	85,651	85,702	85,773	85,845	85,914	85,983	86,053	86,112	86,173
Dallas	287,989	288,216	288,458	288,700	288,906	289,112	289,305	289,487	289,667	289,842	290,000
Denton	70,885	70,947	71,009	71,071	71,239	71,391	71,533	71,660	71,788	71,911	72,028
El Paso	127,661	127,824	127,992	128,119	128,269	128,410	128,544	128,676	128,809	128,938	129,063
Ellis	21,626	21,650	21,650	21,650	21,660	21,670	21,680	21,688	21,696	21,703	21,710
Fort Bend	61,922	61,956	61,991	62,025	62,155	62,286	62,407	62,527	62,644	62,757	62,861
Galveston	36,323	36,383	36,465	36,465	36,531	36,594	36,654	36,713	36,772	36,828	36,882
Harris	368,908	369,613	370,223	370,459	371,017	371,592	372,125	372,665	373,188	373,701	374,211
Hidalgo	83,401	83,444	83,488	83,531	83,808	84,075	84,342	84,615	84,892	85,158	85,433
Johnson	19,044	19,078	19,078	19,078	19,096	19,113	19,130	19,146	19,163	19,178	19,194
Lubbock	48,424	48,433	48,433	48,433	48,444	48,455	48,467	48,477	48,488	48,499	48,509
McLennan	25,713	25,747	25,747	25,747	25,772	25,797	25,822	25,845	25,868	25,891	25,914
Montgomery	48,064	48,161	48,258	48,355	48,467	48,573	48,684	48,794	48,904	49,011	49,115
Tarrant	248,606	248,677	248,748	249,150	249,345	249,537	249,722	249,895	250,069	250,234	250,394
Travis	78,011	78,108	78,193	78,308	78,394	78,482	78,565	78,647	78,729	78,804	78,878
Williamson	42,326	42,375	42,424	42,473	42,530	42,585	42,641	42,694	42,746	42,799	42,849

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:											
	3/19	3/20	3/21	3/22	3/24				3/26				3/28			
Bexar	201,411	201,692	202,550	202,716	203,181	(40,636)	[9,753]	{4,876}	203,667	(40,733)	[9,776]	{4,888}	204,101	(40,820)	[9,797]	{4,898}
Brazoria	34,629	34,691	34,803	34,803	34,933	(6,987)	[1,677]	{838}	35,059	(7,012)	[1,683]	{841}	35,177	(7,035)	[1,689]	{844}
Brazos	22,457	22,484	22,511	22,538	22,659	(4,532)	[1,088]	{544}	22,781	(4,556)	[1,093]	{547}	22,902	(4,580)	[1,099]	{550}
Collin	85,550	85,601	85,651	85,702	85,845	(17,169)	[4,121]	{2,060}	85,983	(17,197)	[4,127]	{2,064}	86,112	(17,222)	[4,133]	{2,067}
Dallas	287,989	288,216	288,458	288,700	289,112	(57,822)	[13,877]	{6,939}	289,487	(57,897)	[13,895]	{6,948}	289,842	(57,968)	[13,912]	{6,956}
Denton	70,885	70,947	71,009	71,071	71,391	(14,278)	[3,427]	{1,713}	71,660	(14,332)	[3,440]	{1,720}	71,911	(14,382)	[3,452]	{1,726}
El Paso	127,661	127,824	127,992	128,119	128,410	(25,682)	[6,164]	{3,082}	128,676	(25,735)	[6,176]	{3,088}	128,938	(25,788)	[6,189]	{3,095}
Ellis	21,626	21,650	21,650	21,650	21,670	(4,334)	[1,040]	{520}	21,688	(4,338)	[1,041]	{521}	21,703	(4,341)	[1,042]	{521}
Fort Bend	61,922	61,956	61,991	62,025	62,286	(12,457)	[2,990]	{1,495}	62,527	(12,505)	[3,001]	{1,501}	62,757	(12,551)	[3,012]	{1,506}
Galveston	36,323	36,383	36,465	36,465	36,594	(7,319)	[1,757]	{878}	36,713	(7,343)	[1,762]	{881}	36,828	(7,366)	[1,768]	{884}
Harris	368,908	369,613	370,223	370,459	371,592	(74,318)	[17,836]	{8,918}	372,665	(74,533)	[17,888]	{8,944}	373,701	(74,740)	[17,938]	{8,969}
Hidalgo	83,401	83,444	83,488	83,531	84,075	(16,815)	[4,036]	{2,018}	84,615	(16,923)	[4,062]	{2,031}	85,158	(17,032)	[4,088]	{2,044}
Johnson	19,044	19,078	19,078	19,078	19,113	(3,823)	[917]	{459}	19,146	(3,829)	[919]	{460}	19,178	(3,836)	[921]	{460}
Lubbock	48,424	48,433	48,433	48,433	48,455	(9,691)	[2,326]	{1,163}	48,477	(9,695)	[2,327]	{1,163}	48,499	(9,700)	[2,328]	{1,164}
McLennan	25,713	25,747	25,747	25,747	25,797	(5,159)	[1,238]	{619}	25,845	(5,169)	[1,241]	{620}	25,891	(5,178)	[1,243]	{621}
Montgomery	48,064	48,161	48,258	48,355	48,573	(9,715)	[2,331]	{1,166}	48,794	(9,759)	[2,342]	{1,171}	49,011	(9,802)	[2,353]	{1,176}
Tarrant	248,606	248,677	248,748	249,150	249,537	(49,907)	[11,978]	{5,989}	249,895	(49,979)	[11,995]	{5,997}	250,234	(50,047)	[12,011]	{6,006}
Travis	78,011	78,108	78,193	78,308	78,482	(15,696)	[3,767]	{1,884}	78,647	(15,729)	[3,775]	{1,888}	78,804	(15,761)	[3,783]	{1,891}
Williamson	42,326	42,375	42,424	42,473	42,585	(8,517)	[2,044]	{1,022}	42,694	(8,539)	[2,049]	{1,025}	42,799	(8,560)	[2,054]	{1,027}

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.