

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

Date: 4/29/21

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 4/29/21 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.

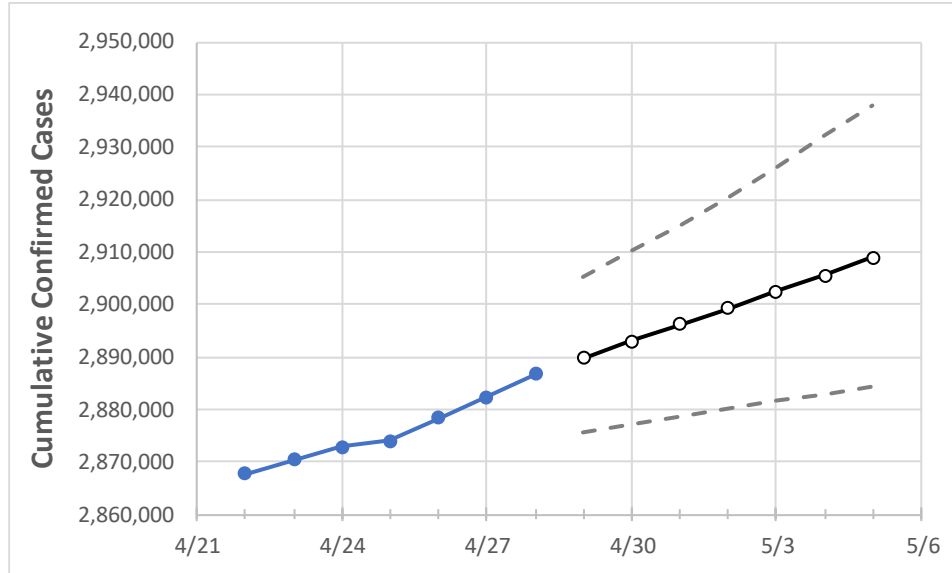
IEM's Modeling Lead

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:							
	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3	5/4	5/5	
Texas	2,873,995	2,878,438	2,882,423	2,886,638	2,889,731	2,892,891	2,896,137	2,899,310	2,902,427	2,905,603	2,908,864	

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:							
	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3	5/4	5/5	
Bexar	215,792	216,339	216,476	216,878	217,259	217,666	218,063	218,453	218,862	219,266	219,669	
Brazoria	36,958	36,992	37,046	37,062	37,103	37,143	37,181	37,219	37,255	37,290	37,326	
Brazos	26,157	26,181	26,205	26,272	26,304	26,337	26,370	26,402	26,434	26,464	26,497	
Collin	89,290	89,285	89,341	89,509	89,625	89,740	89,855	89,977	90,098	90,220	90,342	
Dallas	297,476	297,637	297,812	298,162	298,393	298,622	298,854	299,082	299,310	299,536	299,769	
Denton	73,881	73,925	74,071	74,149	74,222	74,294	74,365	74,435	74,501	74,569	74,637	
El Paso	133,366	133,458	133,533	133,790	133,929	134,066	134,207	134,345	134,482	134,624	134,766	
Ellis	22,482	22,497	22,511	22,611	22,647	22,685	22,723	22,766	22,811	22,860	22,913	
Fort Bend	66,250	66,279	66,386	66,515	66,592	66,668	66,742	66,812	66,881	66,945	67,006	
Galveston	38,647	38,685	38,723	38,808	38,862	38,915	38,968	39,021	39,075	39,129	39,181	
Harris	390,174	390,547	391,087	391,438	391,926	392,409	392,895	393,379	393,875	394,352	394,837	
Hidalgo	87,856	87,879	88,044	88,249	88,350	88,446	88,540	88,638	88,732	88,819	88,907	
Johnson	19,579	19,585	19,591	19,671	19,687	19,704	19,722	19,740	19,759	19,778	19,799	
Lubbock	48,804	48,809	48,815	48,830	48,838	48,846	48,855	48,863	48,872	48,880	48,888	
McLennan	26,781	26,802	26,822	26,836	26,865	26,893	26,922	26,952	26,981	27,009	27,038	
Montgomery	51,846	51,928	52,068	52,207	52,314	52,422	52,529	52,638	52,748	52,861	52,971	
Tarrant	255,681	255,984	256,188	256,333	256,497	256,661	256,822	256,990	257,156	257,310	257,468	
Travis	81,811	81,906	82,057	82,152	82,232	82,310	82,388	82,463	82,539	82,611	82,686	
Williamson	45,018	45,086	45,122	45,215	45,281	45,347	45,411	45,477	45,539	45,604	45,669	

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:											
	4/25	4/26	4/27	4/28	4/30				5/2			5/4				
Bexar	215,792	216,339	216,476	216,878	217,666	(43,533)	[10,448]	{5,224}	218,453	(43,691)	[10,486]	{5,243}	219,266	(43,853)	[10,525]	{5,262}
Brazoria	36,958	36,992	37,046	37,062	37,143	(7,429)	[1,783]	{891}	37,219	(7,444)	[1,786]	{893}	37,290	(7,458)	[1,790]	{895}
Brazos	26,157	26,181	26,205	26,272	26,337	(5,267)	[1,264]	{632}	26,402	(5,280)	[1,267]	{634}	26,464	(5,293)	[1,270]	{635}
Collin	89,290	89,285	89,341	89,509	89,740	(17,948)	[4,308]	{2,154}	89,977	(17,995)	[4,319]	{2,159}	90,220	(18,044)	[4,331]	{2,165}
Dallas	297,476	297,637	297,812	298,162	298,622	(59,724)	[14,334]	{7,167}	299,082	(59,816)	[14,356]	{7,178}	299,536	(59,907)	[14,378]	{7,189}
Denton	73,881	73,925	74,071	74,149	74,294	(14,859)	[3,566]	{1,783}	74,435	(14,887)	[3,573]	{1,786}	74,569	(14,914)	[3,579]	{1,790}
El Paso	133,366	133,458	133,533	133,790	134,066	(26,813)	[6,435]	{3,218}	134,345	(26,869)	[6,449]	{3,224}	134,624	(26,925)	[6,462]	{3,231}
Ellis	22,482	22,497	22,511	22,611	22,685	(4,537)	[1,089]	{544}	22,766	(4,553)	[1,093]	{546}	22,860	(4,572)	[1,097]	{549}
Fort Bend	66,250	66,279	66,386	66,515	66,668	(13,334)	[3,200]	{1,600}	66,812	(13,362)	[3,207]	{1,603}	66,945	(13,389)	[3,213]	{1,607}
Galveston	38,647	38,685	38,723	38,808	38,915	(7,783)	[1,868]	{934}	39,021	(7,804)	[1,873]	{937}	39,129	(7,826)	[1,878]	{939}
Harris	390,174	390,547	391,087	391,438	392,409	(78,482)	[18,836]	{9,418}	393,379	(78,676)	[18,882]	{9,441}	394,352	(78,870)	[18,929]	{9,464}
Hidalgo	87,856	87,879	88,044	88,249	88,446	(17,689)	[4,245]	{2,123}	88,638	(17,728)	[4,255]	{2,127}	88,819	(17,764)	[4,263]	{2,132}
Johnson	19,579	19,585	19,591	19,671	19,704	(3,941)	[946]	{473}	19,740	(3,948)	[948]	{474}	19,778	(3,956)	[949]	{475}
Lubbock	48,804	48,809	48,815	48,830	48,846	(9,769)	[2,345]	{1,172}	48,863	(9,773)	[2,345]	{1,173}	48,880	(9,776)	[2,346]	{1,173}
McLennan	26,781	26,802	26,822	26,836	26,893	(5,379)	[1,291]	{645}	26,952	(5,390)	[1,294]	{647}	27,009	(5,402)	[1,296]	{648}
Montgomery	51,846	51,928	52,068	52,207	52,422	(10,484)	[2,516]	{1,258}	52,638	(10,528)	[2,527]	{1,263}	52,861	(10,572)	[2,537]	{1,269}
Tarrant	255,681	255,984	256,188	256,333	256,661	(51,332)	[12,320]	{6,160}	256,990	(51,398)	[12,336]	{6,168}	257,310	(51,462)	[12,351]	{6,175}
Travis	81,811	81,906	82,057	82,152	82,310	(16,462)	[3,951]	{1,975}	82,463	(16,493)	[3,958]	{1,979}	82,611	(16,522)	[3,965]	{1,983}
Williamson	45,018	45,086	45,122	45,215	45,347	(9,069)	[2,177]	{1,088}	45,477	(9,095)	[2,183]	{1,091}	45,604	(9,121)	[2,189]	{1,094}

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.