

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

Date: 4/8/21

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 4/8/21 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.

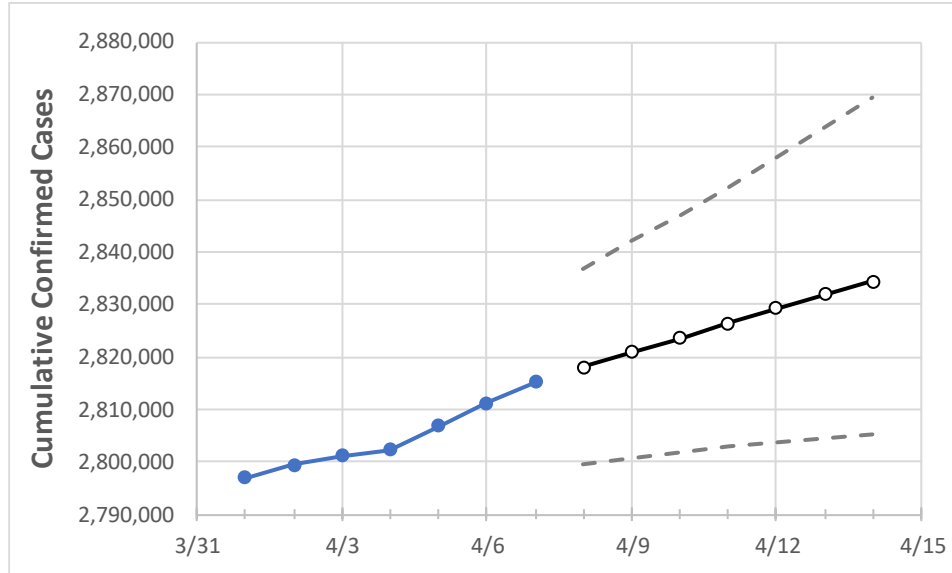
IEM's Modeling Lead

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:							
	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14	
Texas	2,802,225	2,806,908	2,811,270	2,815,110	2,818,053	2,820,911	2,823,607	2,826,421	2,829,183	2,831,819	2,834,462	

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:							
	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14	
Bexar	207,406	207,949	208,172	208,462	208,910	209,372	209,860	210,344	210,827	211,329	211,835	
Brazoria	35,737	35,743	35,749	35,918	35,965	36,011	36,053	36,099	36,142	36,181	36,222	
Brazos	25,255	25,265	25,276	25,326	25,349	25,370	25,390	25,408	25,425	25,440	25,455	
Collin	87,043	87,092	87,267	87,275	87,364	87,458	87,548	87,636	87,726	87,819	87,909	
Dallas	292,259	292,364	292,743	293,121	293,397	293,663	293,916	294,172	294,425	294,666	294,911	
Denton	72,114	72,160	72,321	72,422	72,486	72,548	72,610	72,668	72,725	72,780	72,833	
El Paso	130,102	130,250	130,457	130,647	130,808	130,966	131,131	131,291	131,447	131,605	131,761	
Ellis	22,170	22,177	22,183	22,203	22,219	22,236	22,251	22,267	22,283	22,299	22,314	
Fort Bend	63,602	63,656	64,010	64,113	64,201	64,292	64,383	64,470	64,560	64,644	64,729	
Galveston	37,358	37,397	37,436	37,525	37,579	37,634	37,686	37,738	37,787	37,837	37,886	
Harris	379,461	379,684	380,297	380,652	381,188	381,709	382,211	382,691	383,162	383,633	384,072	
Hidalgo	85,190	85,206	85,296	85,628	85,692	85,755	85,810	85,863	85,914	85,959	86,004	
Johnson	19,368	19,375	19,382	19,396	19,408	19,419	19,430	19,441	19,452	19,461	19,470	
Lubbock	48,622	48,635	48,647	48,661	48,671	48,682	48,691	48,702	48,712	48,722	48,732	
McLennan	26,200	26,218	26,236	26,262	26,283	26,303	26,323	26,342	26,360	26,378	26,395	
Montgomery	49,781	49,839	49,936	50,084	50,163	50,239	50,313	50,387	50,458	50,528	50,592	
Tarrant	251,264	251,316	251,896	252,138	252,302	252,463	252,625	252,784	252,948	253,103	253,266	
Travis	79,569	79,645	79,787	79,922	80,025	80,128	80,231	80,336	80,441	80,546	80,652	
Williamson	43,357	43,384	43,474	43,590	43,647	43,704	43,761	43,817	43,873	43,930	43,986	

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:											
	4/4	4/5	4/6	4/7	4/9			4/11			4/13					
Bexar	207,406	207,949	208,172	208,462	209,372	(41,874)	[10,050]	{5,025}	210,344	(42,069)	[10,097]	{5,048}	211,329	(42,266)	[10,144]	{5,072}
Brazoria	35,737	35,743	35,749	35,918	36,011	(7,202)	[1,729]	{864}	36,099	(7,220)	[1,733]	{866}	36,181	(7,236)	[1,737]	{868}
Brazos	25,255	25,265	25,276	25,326	25,370	(5,074)	[1,218]	{609}	25,408	(5,082)	[1,220]	{610}	25,440	(5,088)	[1,221]	{611}
Collin	87,043	87,092	87,267	87,275	87,458	(17,492)	[4,198]	{2,099}	87,636	(17,527)	[4,207]	{2,103}	87,819	(17,564)	[4,215]	{2,108}
Dallas	292,259	292,364	292,743	293,121	293,663	(58,733)	[14,096]	{7,048}	294,172	(58,834)	[14,120]	{7,060}	294,666	(58,933)	[14,144]	{7,072}
Denton	72,114	72,160	72,321	72,422	72,548	(14,510)	[3,482]	{1,741}	72,668	(14,534)	[3,488]	{1,744}	72,780	(14,556)	[3,493]	{1,747}
El Paso	130,102	130,250	130,457	130,647	130,966	(26,193)	[6,286]	{3,143}	131,291	(26,258)	[6,302]	{3,151}	131,605	(26,321)	[6,317]	{3,159}
Ellis	22,170	22,177	22,183	22,203	22,236	(4,447)	[1,067]	{534}	22,267	(4,453)	[1,069]	{534}	22,299	(4,460)	[1,070]	{535}
Fort Bend	63,602	63,656	64,010	64,113	64,292	(12,858)	[3,086]	{1,543}	64,470	(12,894)	[3,095]	{1,547}	64,644	(12,929)	[3,103]	{1,551}
Galveston	37,358	37,397	37,436	37,525	37,634	(7,527)	[1,806]	{903}	37,738	(7,548)	[1,811]	{906}	37,837	(7,567)	[1,816]	{908}
Harris	379,461	379,684	380,297	380,652	381,709	(76,342)	[18,322]	{9,161}	382,691	(76,538)	[18,369]	{9,185}	383,633	(76,727)	[18,414]	{9,207}
Hidalgo	85,190	85,206	85,296	85,628	85,755	(17,151)	[4,116]	{2,058}	85,863	(17,173)	[4,121]	{2,061}	85,959	(17,192)	[4,126]	{2,063}
Johnson	19,368	19,375	19,382	19,396	19,419	(3,884)	[932]	{466}	19,441	(3,888)	[933]	{467}	19,461	(3,892)	[934]	{467}
Lubbock	48,622	48,635	48,647	48,661	48,682	(9,736)	[2,337]	{1,168}	48,702	(9,740)	[2,338]	{1,169}	48,722	(9,744)	[2,339]	{1,169}
McLennan	26,200	26,218	26,236	26,262	26,303	(5,261)	[1,263]	{631}	26,342	(5,268)	[1,264]	{632}	26,378	(5,276)	[1,266]	{633}
Montgomery	49,781	49,839	49,936	50,084	50,239	(10,048)	[2,411]	{1,206}	50,387	(10,077)	[2,419]	{1,209}	50,528	(10,106)	[2,425]	{1,213}
Tarrant	251,264	251,316	251,896	252,138	252,463	(50,493)	[12,118]	{6,059}	252,784	(50,557)	[12,134]	{6,067}	253,103	(50,621)	[12,149]	{6,074}
Travis	79,569	79,645	79,787	79,922	80,128	(16,026)	[3,846]	{1,923}	80,336	(16,067)	[3,856]	{1,928}	80,546	(16,109)	[3,866]	{1,933}
Williamson	43,357	43,384	43,474	43,590	43,704	(8,741)	[2,098]	{1,049}	43,817	(8,763)	[2,103]	{1,052}	43,930	(8,786)	[2,109]	{1,054}

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.