

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

Date: 2/3/21

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 2/3/21 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.

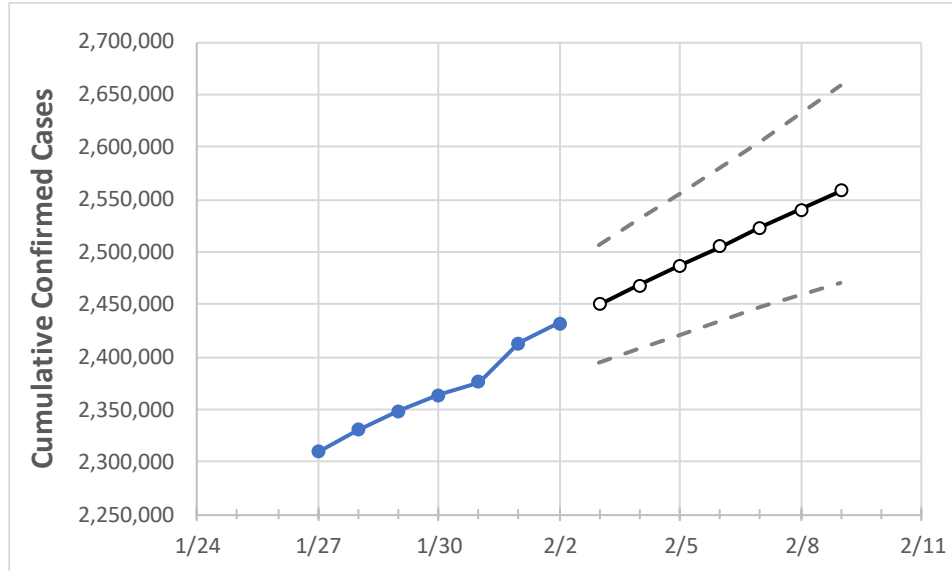
IEM's Modeling Lead

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:							
	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8	2/9	
Texas	2,363,266	2,376,344	2,412,627	2,431,687	2,450,019	2,468,217	2,486,821	2,504,987	2,522,830	2,540,064	2,557,908	

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:							
	1/30	1/31	2/1	2/2	2/3	2/4	2/5	2/6	2/7	2/8	2/9	
Bexar	169,688	173,154	175,530	176,790	178,525	180,272	182,019	183,835	185,604	187,359	189,038	
Brazoria	28,746	28,981	29,105	29,343	29,542	29,736	29,934	30,126	30,314	30,503	30,687	
Brazos	18,698	18,804	18,928	18,998	19,120	19,243	19,361	19,477	19,592	19,706	19,820	
Collin	72,370	72,705	73,580	74,243	74,834	75,423	76,007	76,578	77,151	77,702	78,251	
Dallas	256,900	258,517	259,944	261,382	262,792	264,165	265,511	266,839	268,126	269,332	270,508	
Denton	53,554	53,854	54,154	54,742	55,248	55,754	56,261	56,770	57,282	57,824	58,346	
El Paso	113,145	113,637	114,058	114,386	114,829	115,268	115,717	116,179	116,616	117,071	117,525	
Ellis	18,561	18,702	18,843	18,984	19,108	19,231	19,351	19,472	19,585	19,697	19,808	
Fort Bend	50,117	50,243	50,368	51,601	52,040	52,460	52,898	53,339	53,771	54,216	54,638	
Galveston	30,376	30,529	30,717	30,904	31,125	31,337	31,549	31,759	31,972	32,181	32,374	
Harris	314,697	317,654	319,800	320,744	322,902	325,144	327,329	329,431	331,526	333,755	335,833	
Hidalgo	63,795	64,040	64,284	65,456	66,044	66,634	67,238	67,855	68,464	69,099	69,738	
Johnson	16,483	16,601	16,720	16,838	16,948	17,053	17,157	17,258	17,360	17,455	17,549	
Lubbock	46,802	46,862	46,942	47,020	47,093	47,161	47,228	47,293	47,354	47,414	47,472	
McLennan	23,140	23,200	23,242	23,284	23,334	23,384	23,430	23,475	23,515	23,553	23,589	
Montgomery	39,508	39,775	40,042	40,360	40,762	41,158	41,551	41,945	42,345	42,740	43,128	
Tarrant	215,979	216,910	220,685	222,111	223,742	225,352	226,933	228,486	230,016	231,520	233,026	
Travis	68,290	68,731	69,408	70,089	70,602	71,105	71,609	72,109	72,608	73,108	73,591	
Williamson	36,054	36,451	36,848	37,189	37,579	37,961	38,340	38,713	39,089	39,453	39,818	

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:											
	1/30	1/31	2/1	2/2	2/4			2/6			2/8					
Bexar	169,688	173,154	175,530	176,790	180,272	(36,054)	[8,653]	{4,327}	183,835	(36,767)	[8,824]	{4,412}	187,359	(37,472)	[8,993]	{4,497}
Brazoria	28,746	28,981	29,105	29,343	29,736	(5,947)	[1,427]	{714}	30,126	(6,025)	[1,446]	{723}	30,503	(6,101)	[1,464]	{732}
Brazos	18,698	18,804	18,928	18,998	19,243	(3,849)	[924]	{462}	19,477	(3,895)	[935]	{467}	19,706	(3,941)	[946]	{473}
Collin	72,370	72,705	73,580	74,243	75,423	(15,085)	[3,620]	{1,810}	76,578	(15,316)	[3,676]	{1,838}	77,702	(15,540)	[3,730]	{1,865}
Dallas	256,900	258,517	259,944	261,382	264,165	(52,833)	[12,680]	{6,340}	266,839	(53,368)	[12,808]	{6,404}	269,332	(53,866)	[12,928]	{6,464}
Denton	53,554	53,854	54,154	54,742	55,754	(11,151)	[2,676]	{1,338}	56,770	(11,354)	[2,725]	{1,362}	57,824	(11,565)	[2,776]	{1,388}
El Paso	113,145	113,637	114,058	114,386	115,268	(23,054)	[5,533]	{2,766}	116,179	(23,236)	[5,577]	{2,788}	117,071	(23,414)	[5,619]	{2,810}
Ellis	18,561	18,702	18,843	18,984	19,231	(3,846)	[923]	{462}	19,472	(3,894)	[935]	{467}	19,697	(3,939)	[945]	{473}
Fort Bend	50,117	50,243	50,368	51,601	52,460	(10,492)	[2,518]	{1,259}	53,339	(10,668)	[2,560]	{1,280}	54,216	(10,843)	[2,602]	{1,301}
Galveston	30,376	30,529	30,717	30,904	31,337	(6,267)	[1,504]	{752}	31,759	(6,352)	[1,524]	{762}	32,181	(6,436)	[1,545]	{772}
Harris	314,697	317,654	319,800	320,744	325,144	(65,029)	[15,607]	{7,803}	329,431	(65,886)	[15,813]	{7,906}	333,755	(66,751)	[16,020]	{8,010}
Hidalgo	63,795	64,040	64,284	65,456	66,634	(13,327)	[3,198]	{1,599}	67,855	(13,571)	[3,257]	{1,629}	69,099	(13,820)	[3,317]	{1,658}
Johnson	16,483	16,601	16,720	16,838	17,053	(3,411)	[819]	{409}	17,258	(3,452)	[828]	{414}	17,455	(3,491)	[838]	{419}
Lubbock	46,802	46,862	46,942	47,020	47,161	(9,432)	[2,264]	{1,132}	47,293	(9,459)	[2,270]	{1,135}	47,414	(9,483)	[2,276]	{1,138}
McLennan	23,140	23,200	23,242	23,284	23,384	(4,677)	[1,122]	{561}	23,475	(4,695)	[1,127]	{563}	23,553	(4,711)	[1,131]	{565}
Montgomery	39,508	39,775	40,042	40,360	41,158	(8,232)	[1,976]	{988}	41,945	(8,389)	[2,013]	{1,007}	42,740	(8,548)	[2,052]	{1,026}
Tarrant	215,979	216,910	220,685	222,111	225,352	(45,070)	[10,817]	{5,408}	228,486	(45,697)	[10,967]	{5,484}	231,520	(46,304)	[11,113]	{5,556}
Travis	68,290	68,731	69,408	70,089	71,105	(14,221)	[3,413]	{1,707}	72,109	(14,422)	[3,461]	{1,731}	73,108	(14,622)	[3,509]	{1,755}
Williamson	36,054	36,451	36,848	37,189	37,961	(7,592)	[1,822]	{911}	38,713	(7,743)	[1,858]	{929}	39,453	(7,891)	[1,894]	{947}

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.