

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

Date: 3/3/21

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 3/3/21 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.

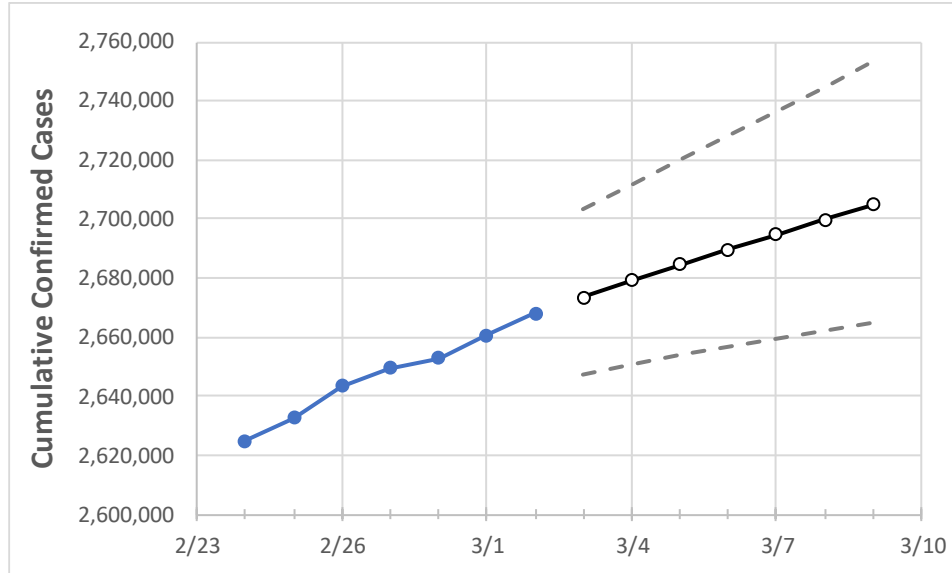
IEM's Modeling Lead

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:						
	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9
Texas	2,649,363	2,653,013	2,660,791	2,668,091	2,673,597	2,679,155	2,684,511	2,689,710	2,694,874	2,699,908	2,704,730

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:						
	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9
Bexar	195,719	196,528	196,816	197,065	197,550	198,043	198,515	198,963	199,403	199,862	200,284
Brazoria	32,645	32,834	32,966	33,040	33,167	33,299	33,430	33,563	33,694	33,823	33,947
Brazos	20,964	21,005	21,046	21,172	21,232	21,292	21,352	21,412	21,471	21,530	21,589
Collin	83,100	83,289	83,404	83,404	83,568	83,726	83,872	84,014	84,161	84,293	84,423
Dallas	280,404	280,780	281,155	281,681	281,985	282,281	282,566	282,832	283,095	283,342	283,579
Denton	63,994	64,346	64,697	65,171	65,551	65,936	66,321	66,725	67,122	67,534	67,956
El Paso	123,445	123,690	123,979	124,162	124,394	124,619	124,833	125,061	125,288	125,500	125,706
Ellis	20,714	20,754	20,793	20,833	20,860	20,887	20,913	20,938	20,961	20,984	21,007
Fort Bend	57,622	57,671	57,721	58,219	58,368	58,509	58,645	58,784	58,917	59,049	59,177
Galveston	34,431	34,591	34,664	34,736	34,826	34,908	34,991	35,072	35,152	35,231	35,309
Harris	348,848	350,201	351,063	353,450	354,546	355,641	356,766	357,826	358,983	360,139	361,263
Hidalgo	76,893	77,103	77,312	77,702	78,129	78,554	78,974	79,389	79,812	80,228	80,647
Johnson	18,518	18,548	18,578	18,608	18,635	18,661	18,686	18,708	18,731	18,752	18,773
Lubbock	48,123	48,147	48,160	48,175	48,192	48,207	48,223	48,237	48,251	48,264	48,277
McLennan	25,024	25,060	25,096	25,132	25,187	25,242	25,295	25,347	25,401	25,451	25,504
Montgomery	45,175	45,352	45,528	45,635	45,763	45,885	46,007	46,126	46,244	46,359	46,477
Tarrant	241,650	242,144	242,638	243,067	243,491	243,897	244,299	244,702	245,092	245,476	245,839
Travis	75,617	75,636	75,901	76,088	76,210	76,324	76,436	76,544	76,654	76,763	76,863
Williamson	40,769	40,848	40,927	41,137	41,230	41,321	41,415	41,507	41,600	41,695	41,790

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:											
	2/27	2/28	3/1	3/2	3/4				3/6				3/8			
Bexar	195,719	196,528	196,816	197,065	198,043	(39,609)	[9,506]	{4,753}	198,963	(39,793)	[9,550]	{4,775}	199,862	(39,972)	[9,593]	{4,797}
Brazoria	32,645	32,834	32,966	33,040	33,299	(6,660)	[1,598]	{799}	33,563	(6,713)	[1,611]	{806}	33,823	(6,765)	[1,624]	{812}
Brazos	20,964	21,005	21,046	21,172	21,292	(4,258)	[1,022]	{511}	21,412	(4,282)	[1,028]	{514}	21,530	(4,306)	[1,033]	{517}
Collin	83,100	83,289	83,404	83,404	83,726	(16,745)	[4,019]	{2,009}	84,014	(16,803)	[4,033]	{2,016}	84,293	(16,859)	[4,046]	{2,023}
Dallas	280,404	280,780	281,155	281,681	282,281	(56,456)	[13,549]	{6,775}	282,832	(56,566)	[13,576]	{6,788}	283,342	(56,668)	[13,600]	{6,800}
Denton	63,994	64,346	64,697	65,171	65,936	(13,187)	[3,165]	{1,582}	66,725	(13,345)	[3,203]	{1,601}	67,534	(13,507)	[3,242]	{1,621}
El Paso	123,445	123,690	123,979	124,162	124,619	(24,924)	[5,982]	{2,991}	125,061	(25,012)	[6,003]	{3,001}	125,500	(25,100)	[6,024]	{3,012}
Ellis	20,714	20,754	20,793	20,833	20,887	(4,177)	[1,003]	{501}	20,938	(4,188)	[1,005]	{503}	20,984	(4,197)	[1,007]	{504}
Fort Bend	57,622	57,671	57,721	58,219	58,509	(11,702)	[2,808]	{1,404}	58,784	(11,757)	[2,822]	{1,411}	59,049	(11,810)	[2,834]	{1,417}
Galveston	34,431	34,591	34,664	34,736	34,908	(6,982)	[1,676]	{838}	35,072	(7,014)	[1,683]	{842}	35,231	(7,046)	[1,691]	{846}
Harris	348,848	350,201	351,063	353,450	355,641	(71,128)	[17,071]	{8,535}	357,826	(71,565)	[17,176]	{8,588}	360,139	(72,028)	[17,287]	{8,643}
Hidalgo	76,893	77,103	77,312	77,702	78,554	(15,711)	[3,771]	{1,885}	79,389	(15,878)	[3,811]	{1,905}	80,228	(16,046)	[3,851]	{1,925}
Johnson	18,518	18,548	18,578	18,608	18,661	(3,732)	[896]	{448}	18,708	(3,742)	[898]	{449}	18,752	(3,750)	[900]	{450}
Lubbock	48,123	48,147	48,160	48,175	48,207	(9,641)	[2,314]	{1,157}	48,237	(9,647)	[2,315]	{1,158}	48,264	(9,653)	[2,317]	{1,158}
McLennan	25,024	25,060	25,096	25,132	25,242	(5,048)	[1,212]	{606}	25,347	(5,069)	[1,217]	{608}	25,451	(5,090)	[1,222]	{611}
Montgomery	45,175	45,352	45,528	45,635	45,885	(9,177)	[2,202]	{1,101}	46,126	(9,225)	[2,214]	{1,107}	46,359	(9,272)	[2,225]	{1,113}
Tarrant	241,650	242,144	242,638	243,067	243,897	(48,779)	[11,707]	{5,854}	244,702	(48,940)	[11,746]	{5,873}	245,476	(49,095)	[11,783]	{5,891}
Travis	75,617	75,636	75,901	76,088	76,324	(15,265)	[3,664]	{1,832}	76,544	(15,309)	[3,674]	{1,837}	76,763	(15,353)	[3,685]	{1,842}
Williamson	40,769	40,848	40,927	41,137	41,321	(8,264)	[1,983]	{992}	41,507	(8,301)	[1,992]	{996}	41,695	(8,339)	[2,001]	{1,001}

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.