

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

Date: 2/23/22

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 2/23/22 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.

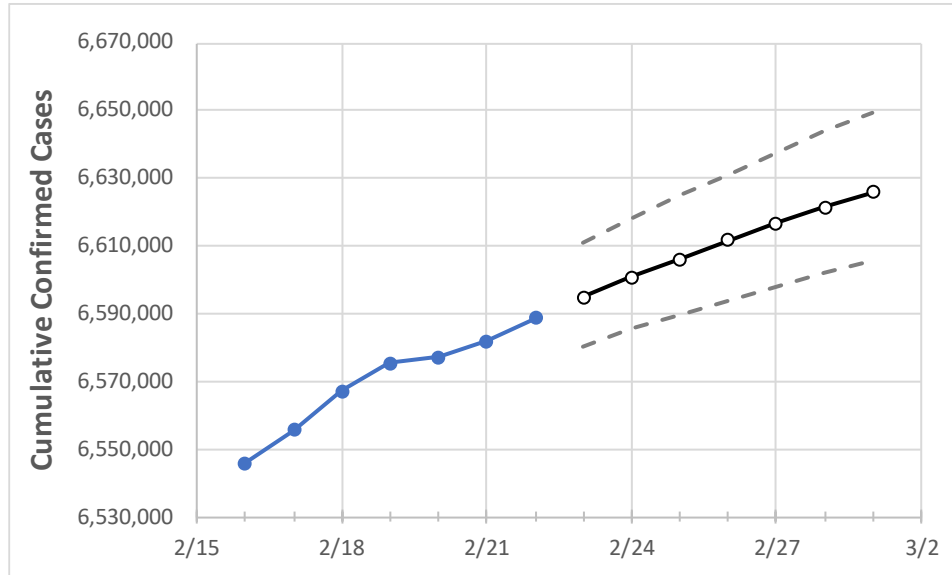
IEM's Modeling Lead

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Texas	6,575,378	6,577,038	6,581,927	6,588,651	6,594,999	6,600,782	6,606,189	6,611,774	6,616,758	6,621,552	6,625,968

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:						
	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1
Bexar	540,301	540,475	540,846	541,569	542,098	542,605	543,086	543,553	543,946	544,357	544,729
Brazoria	92,255	92,289	92,350	92,429	92,495	92,558	92,616	92,671	92,726	92,779	92,824
Brazos	59,403	59,420	59,432	59,467	59,507	59,542	59,578	59,615	59,645	59,674	59,706
Collin	202,006	202,048	202,137	202,438	202,644	202,835	203,017	203,201	203,362	203,525	203,677
Dallas	562,735	562,814	563,249	563,579	563,940	564,303	564,595	564,889	565,191	565,517	565,760
Denton	174,849	174,961	175,072	175,184	175,364	175,529	175,697	175,840	175,983	176,122	176,235
El Paso	202,438	202,478	202,617	202,762	202,898	203,027	203,141	203,255	203,367	203,466	203,567
Ellis	47,862	47,871	47,894	47,911	47,938	47,964	47,990	48,013	48,035	48,057	48,076
Fort Bend	174,809	174,877	175,025	175,347	175,666	175,965	176,263	176,546	176,833	177,071	177,338
Galveston	94,282	94,318	94,357	94,416	94,511	94,595	94,685	94,754	94,836	94,923	94,992
Harris	987,563	987,881	989,076	990,143	991,021	991,839	992,662	993,391	994,238	994,979	995,664
Hidalgo	189,665	189,794	190,399	190,685	191,185	191,644	192,101	192,564	192,994	193,425	193,819
Johnson	41,464	41,469	41,486	41,501	41,530	41,559	41,584	41,610	41,634	41,656	41,678
Lubbock	92,799	92,817	92,842	92,876	92,912	92,946	92,977	93,005	93,034	93,062	93,085
McLennan	55,820	55,831	55,843	55,942	56,030	56,110	56,182	56,251	56,349	56,407	56,492
Montgomery	134,454	134,511	134,695	134,837	134,960	135,084	135,195	135,308	135,415	135,519	135,609
Tarrant	555,033	555,171	555,308	555,445	555,840	556,255	556,639	556,966	557,266	557,619	557,874
Travis	217,842	217,921	218,043	218,183	218,320	218,445	218,560	218,673	218,780	218,874	218,969
Williamson	130,338	130,425	130,511	130,597	130,706	130,803	130,895	130,983	131,067	131,146	131,218

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:											
	2/19	2/20	2/21	2/22	2/24			2/26			2/28					
Bexar	540,301	540,475	540,846	541,569	542,605	(108,521)	[26,045]	{13,023}	543,553	(108,711)	[26,091]	{13,045}	544,357	(108,871)	[26,129]	{13,065}
Brazoria	92,255	92,289	92,350	92,429	92,558	(18,512)	[4,443]	{2,221}	92,671	(18,534)	[4,448]	{2,224}	92,779	(18,556)	[4,453]	{2,227}
Brazos	59,403	59,420	59,432	59,467	59,542	(11,908)	[2,858]	{1,429}	59,615	(11,923)	[2,862]	{1,431}	59,674	(11,935)	[2,864]	{1,432}
Collin	202,006	202,048	202,137	202,438	202,835	(40,567)	[9,736]	{4,868}	203,201	(40,640)	[9,754]	{4,877}	203,525	(40,705)	[9,769]	{4,885}
Dallas	562,735	562,814	563,249	563,579	564,303	(112,861)	[27,087]	{13,543}	564,889	(112,978)	[27,115]	{13,557}	565,517	(113,103)	[27,145]	{13,572}
Denton	174,849	174,961	175,072	175,184	175,529	(35,106)	[8,425]	{4,213}	175,840	(35,168)	[8,440]	{4,220}	176,122	(35,224)	[8,454]	{4,227}
El Paso	202,438	202,478	202,617	202,762	203,027	(40,605)	[9,745]	{4,873}	203,255	(40,651)	[9,756]	{4,878}	203,466	(40,693)	[9,766]	{4,883}
Ellis	47,862	47,871	47,894	47,911	47,964	(9,593)	[2,302]	{1,151}	48,013	(9,603)	[2,305]	{1,152}	48,057	(9,611)	[2,307]	{1,153}
Fort Bend	174,809	174,877	175,025	175,347	175,965	(35,193)	[8,446]	{4,223}	176,546	(35,309)	[8,474]	{4,237}	177,071	(35,414)	[8,499]	{4,250}
Galveston	94,282	94,318	94,357	94,416	94,595	(18,919)	[4,541]	{2,270}	94,754	(18,951)	[4,548]	{2,274}	94,923	(18,985)	[4,556]	{2,278}
Harris	987,563	987,881	989,076	990,143	991,839	(198,368)	[47,608]	{23,804}	993,391	(198,678)	[47,683]	{23,841}	994,979	(198,996)	[47,759]	{23,880}
Hidalgo	189,665	189,794	190,399	190,685	191,644	(38,329)	[9,199]	{4,599}	192,564	(38,513)	[9,243]	{4,622}	193,425	(38,685)	[9,284]	{4,642}
Johnson	41,464	41,469	41,486	41,501	41,559	(8,312)	[1,995]	{997}	41,610	(8,322)	[1,997]	{999}	41,656	(8,331)	[1,999]	{1,000}
Lubbock	92,799	92,817	92,842	92,876	92,946	(18,589)	[4,461]	{2,231}	93,005	(18,601)	[4,464]	{2,232}	93,062	(18,612)	[4,467]	{2,233}
McLennan	55,820	55,831	55,843	55,942	56,110	(11,222)	[2,693]	{1,347}	56,251	(11,250)	[2,700]	{1,350}	56,407	(11,281)	[2,708]	{1,354}
Montgomery	134,454	134,511	134,695	134,837	135,084	(27,017)	[6,484]	{3,242}	135,308	(27,062)	[6,495]	{3,247}	135,519	(27,104)	[6,505]	{3,252}
Tarrant	555,033	555,171	555,308	555,445	556,255	(111,251)	[26,700]	{13,350}	556,966	(111,393)	[26,734]	{13,367}	557,619	(111,524)	[26,766]	{13,383}
Travis	217,842	217,921	218,043	218,183	218,445	(43,689)	[10,485]	{5,243}	218,673	(43,735)	[10,496]	{5,248}	218,874	(43,775)	[10,506]	{5,253}
Williamson	130,338	130,425	130,511	130,597	130,803	(26,161)	[6,279]	{3,139}	130,983	(26,197)	[6,287]	{3,144}	131,146	(26,229)	[6,295]	{3,148}

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.