

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

Date: 1/13/21

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 1/13/21 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.

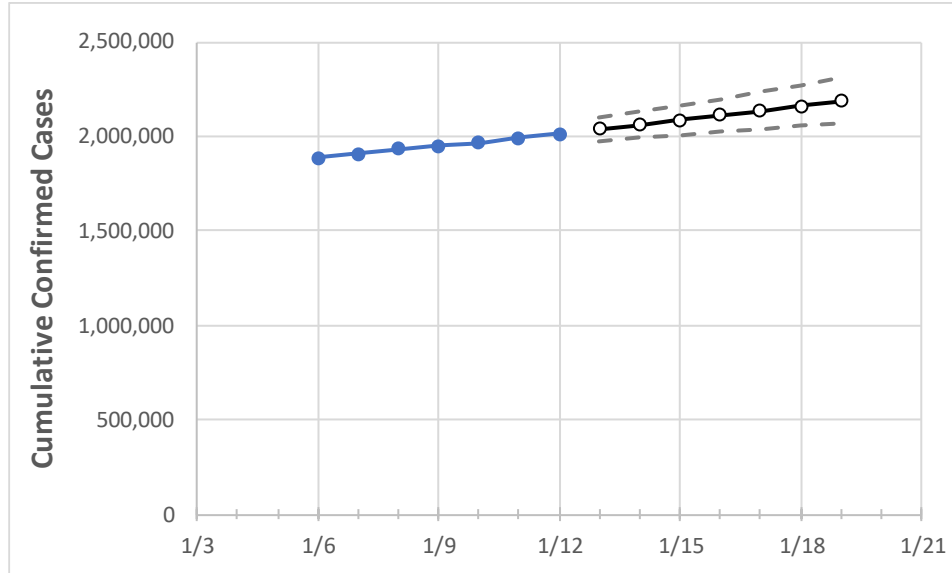
IEM's Modeling Lead

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:						
	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19
Texas	1,951,915	1,968,189	1,990,204	2,014,645	2,038,298	2,062,437	2,086,518	2,111,960	2,136,926	2,162,507	2,188,399

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:						
	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19
Bexar	131,333	133,519	135,104	137,407	139,312	141,284	143,284	145,341	147,458	149,568	151,745
Brazoria	23,704	24,013	24,112	24,381	24,656	24,925	25,209	25,490	25,777	26,059	26,358
Brazos	15,694	15,816	15,965	16,087	16,258	16,430	16,611	16,795	16,983	17,174	17,374
Collin	56,236	56,988	57,870	58,968	59,927	60,911	61,912	62,925	63,971	65,026	66,111
Dallas	214,973	217,219	219,086	222,635	225,499	228,420	231,454	234,607	237,803	240,980	244,347
Denton	43,107	43,344	43,580	44,158	44,596	45,040	45,481	45,921	46,365	46,796	47,255
El Paso	102,889	103,197	103,787	104,085	104,598	105,131	105,670	106,223	106,773	107,339	107,913
Ellis	14,984	15,215	15,445	15,676	15,907	16,139	16,373	16,612	16,853	17,103	17,351
Fort Bend	39,822	39,983	40,143	41,264	41,744	42,235	42,763	43,296	43,820	44,377	44,968
Galveston	23,755	24,028	24,288	24,548	24,813	25,082	25,357	25,637	25,911	26,177	26,453
Harris	259,773	262,525	266,525	267,729	270,667	273,588	276,579	279,640	282,897	286,174	289,702
Hidalgo	54,779	54,959	55,138	55,626	56,043	56,478	56,919	57,369	57,837	58,303	58,790
Johnson	12,912	13,075	13,238	13,401	13,621	13,850	14,084	14,310	14,545	14,786	15,030
Lubbock	44,095	44,238	44,411	44,547	44,733	44,920	45,092	45,260	45,433	45,607	45,777
McLennan	20,471	20,594	20,712	20,829	21,011	21,195	21,380	21,567	21,758	21,948	22,144
Montgomery	30,362	30,731	31,099	31,822	32,256	32,689	33,129	33,597	34,064	34,532	35,004
Tarrant	172,285	173,840	178,977	180,794	183,423	186,091	188,854	191,603	194,499	197,380	200,435
Travis	55,870	56,348	56,825	56,825	57,435	58,045	58,678	59,308	59,951	60,606	61,309
Williamson	26,890	27,267	27,645	28,187	28,690	29,212	29,752	30,294	30,835	31,389	31,985

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:											
	1/9	1/10	1/11	1/12	1/14				1/16				1/18			
Bexar	131,333	133,519	135,104	137,407	141,284	(28,257)	[6,782]	{3,391}	145,341	(29,068)	[6,976]	{3,488}	149,568	(29,914)	[7,179]	{3,590}
Brazoria	23,704	24,013	24,112	24,381	24,925	(4,985)	[1,196]	{598}	25,490	(5,098)	[1,224]	{612}	26,059	(5,212)	[1,251]	{625}
Brazos	15,694	15,816	15,965	16,087	16,430	(3,286)	[789]	{394}	16,795	(3,359)	[806]	{403}	17,174	(3,435)	[824]	{412}
Collin	56,236	56,988	57,870	58,968	60,911	(12,182)	[2,924]	{1,462}	62,925	(12,585)	[3,020]	{1,510}	65,026	(13,005)	[3,121]	{1,561}
Dallas	214,973	217,219	219,086	222,635	228,420	(45,684)	[10,964]	{5,482}	234,607	(46,921)	[11,261]	{5,631}	240,980	(48,196)	[11,567]	{5,784}
Denton	43,107	43,344	43,580	44,158	45,040	(9,008)	[2,162]	{1,081}	45,921	(9,184)	[2,204]	{1,102}	46,796	(9,359)	[2,246]	{1,123}
El Paso	102,889	103,197	103,787	104,085	105,131	(21,026)	[5,046]	{2,523}	106,223	(21,245)	[5,099]	{2,549}	107,339	(21,468)	[5,152]	{2,576}
Ellis	14,984	15,215	15,445	15,676	16,139	(3,228)	[775]	{387}	16,612	(3,322)	[797]	{399}	17,103	(3,421)	[821]	{410}
Fort Bend	39,822	39,983	40,143	41,264	42,235	(8,447)	[2,027]	{1,014}	43,296	(8,659)	[2,078]	{1,039}	44,377	(8,875)	[2,130]	{1,065}
Galveston	23,755	24,028	24,288	24,548	25,082	(5,016)	[1,204]	{602}	25,637	(5,127)	[1,231]	{615}	26,177	(5,235)	[1,257]	{628}
Harris	259,773	262,525	266,525	267,729	273,588	(54,718)	[13,132]	{6,566}	279,640	(55,928)	[13,423]	{6,711}	286,174	(57,235)	[13,736]	{6,868}
Hidalgo	54,779	54,959	55,138	55,626	56,478	(11,296)	[2,711]	{1,355}	57,369	(11,474)	[2,754]	{1,377}	58,303	(11,661)	[2,799]	{1,399}
Johnson	12,912	13,075	13,238	13,401	13,850	(2,770)	[665]	{332}	14,310	(2,862)	[687]	{343}	14,786	(2,957)	[710]	{355}
Lubbock	44,095	44,238	44,411	44,547	44,920	(8,984)	[2,156]	{1,078}	45,260	(9,052)	[2,172]	{1,086}	45,607	(9,121)	[2,189]	{1,095}
McLennan	20,471	20,594	20,712	20,829	21,195	(4,239)	[1,017]	{509}	21,567	(4,313)	[1,035]	{518}	21,948	(4,390)	[1,053]	{527}
Montgomery	30,362	30,731	31,099	31,822	32,689	(6,538)	[1,569]	{785}	33,597	(6,719)	[1,613]	{806}	34,532	(6,906)	[1,658]	{829}
Tarrant	172,285	173,840	178,977	180,794	186,091	(37,218)	[8,932]	{4,466}	191,603	(38,321)	[9,197]	{4,598}	197,380	(39,476)	[9,474]	{4,737}
Travis	55,870	56,348	56,825	56,825	58,045	(11,609)	[2,786]	{1,393}	59,308	(11,862)	[2,847]	{1,423}	60,606	(12,121)	[2,909]	{1,455}
Williamson	26,890	27,267	27,645	28,187	29,212	(5,842)	[1,402]	{701}	30,294	(6,059)	[1,454]	{727}	31,389	(6,278)	[1,507]	{753}

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.