

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 12/15/20**

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 12/15/20 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.

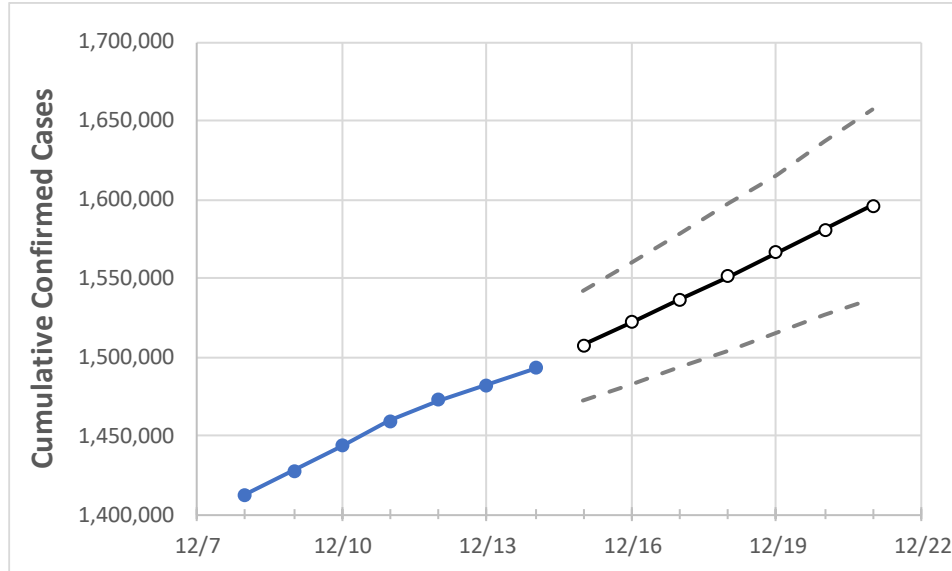
IEM's Modeling Lead

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:						
	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21
Texas	1,459,415	1,472,853	1,481,899	1,492,917	1,507,421	1,521,995	1,536,636	1,551,344	1,566,118	1,580,955	1,595,854

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 20%, and are often within 10%, of actual confirmed cases.

Texas Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21
Bexar	92,484	93,476	94,182	94,781	95,853	96,941	98,046	99,166	100,303	101,456	102,626
Brazoria	16,534	16,762	16,907	17,386	17,681	17,994	18,326	18,677	19,049	19,442	19,858
Brazos	12,261	12,390	12,464	12,571	12,688	12,808	12,930	13,055	13,182	13,311	13,443
Collin	33,946	34,709	35,186	35,794	36,498	37,222	37,968	38,736	39,527	40,340	41,176
Dallas	156,225	158,336	160,146	161,845	163,740	165,677	167,656	169,679	171,746	173,857	176,014
Denton	29,463	29,886	30,306	30,725	31,357	32,013	32,694	33,401	34,134	34,895	35,684
El Paso	91,868	92,584	92,810	93,223	93,522	93,807	94,079	94,339	94,587	94,824	95,050
Ellis	9,635	9,726	9,726	9,726	9,876	10,028	10,183	10,339	10,496	10,656	10,818
Fort Bend	29,461	29,594	29,844	29,844	30,557	31,330	32,167	33,075	34,057	35,120	36,267
Galveston	16,909	17,131	17,362	17,362	17,549	17,743	17,945	18,156	18,376	18,605	18,843
Harris	204,850	205,928	207,406	208,737	210,022	211,328	212,655	214,003	215,373	216,763	218,175
Hidalgo	47,109	47,260	47,411	47,562	47,816	48,069	48,323	48,576	48,829	49,083	49,336
Johnson	7,959	8,072	8,072	8,072	8,261	8,455	8,656	8,863	9,077	9,297	9,525
Lubbock	35,684	35,977	36,261	36,611	36,853	37,090	37,320	37,544	37,763	37,977	38,184
McLennan	15,990	16,127	16,274	16,274	16,431	16,589	16,749	16,910	17,073	17,236	17,402
Montgomery	20,619	20,815	21,012	21,208	21,452	21,697	21,943	22,191	22,441	22,692	22,944
Tarrant	116,931	118,207	119,630	120,899	122,359	123,832	125,320	126,820	128,334	129,862	131,403
Travis	41,901	42,136	42,441	42,856	43,217	43,586	43,962	44,345	44,736	45,135	45,541
Williamson	16,858	17,129	17,129	17,129	17,406	17,692	17,987	18,291	18,605	18,929	19,262

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:											
	12/11	12/12	12/13	12/14	12/16				12/18				12/20			
Bexar	92,484	93,476	94,182	94,781	96,941	(19,388)	[4,653]	{2,327}	99,166	(19,833)	[4,760]	{2,380}	101,456	(20,291)	[4,870]	{2,435}
Brazoria	16,534	16,762	16,907	17,386	17,994	(3,599)	[864]	{432}	18,677	(3,735)	[897]	{448}	19,442	(3,888)	[933]	{467}
Brazos	12,261	12,390	12,464	12,571	12,808	(2,562)	[615]	{307}	13,055	(2,611)	[627]	{313}	13,311	(2,662)	[639]	{319}
Collin	33,946	34,709	35,186	35,794	37,222	(7,444)	[1,787]	{893}	38,736	(7,747)	[1,859]	{930}	40,340	(8,068)	[1,936]	{968}
Dallas	156,225	158,336	160,146	161,845	165,677	(33,135)	[7,952]	{3,976}	169,679	(33,936)	[8,145]	{4,072}	173,857	(34,771)	[8,345]	{4,173}
Denton	29,463	29,886	30,306	30,725	32,013	(6,403)	[1,537]	{768}	33,401	(6,680)	[1,603]	{802}	34,895	(6,979)	[1,675]	{837}
El Paso	91,868	92,584	92,810	93,223	93,807	(18,761)	[4,503]	{2,251}	94,339	(18,868)	[4,528]	{2,264}	94,824	(18,965)	[4,552]	{2,276}
Ellis	9,635	9,726	9,726	9,726	10,028	(2,006)	[481]	{241}	10,339	(2,068)	[496]	{248}	10,656	(2,131)	[511]	{256}
Fort Bend	29,461	29,594	29,844	29,844	31,330	(6,266)	[1,504]	{752}	33,075	(6,615)	[1,588]	{794}	35,120	(7,024)	[1,686]	{843}
Galveston	16,909	17,131	17,362	17,362	17,743	(3,549)	[852]	{426}	18,156	(3,631)	[872]	{436}	18,605	(3,721)	[893]	{447}
Harris	204,850	205,928	207,406	208,737	211,328	(42,266)	[10,144]	{5,072}	214,003	(42,801)	[10,272]	{5,136}	216,763	(43,353)	[10,405]	{5,202}
Hidalgo	47,109	47,260	47,411	47,562	48,069	(9,614)	[2,307]	{1,154}	48,576	(9,715)	[2,332]	{1,166}	49,083	(9,817)	[2,356]	{1,178}
Johnson	7,959	8,072	8,072	8,072	8,455	(1,691)	[406]	{203}	8,863	(1,773)	[425]	{213}	9,297	(1,859)	[446]	{223}
Lubbock	35,684	35,977	36,261	36,611	37,090	(7,418)	[1,780]	{890}	37,544	(7,509)	[1,802]	{901}	37,977	(7,595)	[1,823]	{911}
McLennan	15,990	16,127	16,274	16,274	16,589	(3,318)	[796]	{398}	16,910	(3,382)	[812]	{406}	17,236	(3,447)	[827]	{414}
Montgomery	20,619	20,815	21,012	21,208	21,697	(4,339)	[1,041]	{521}	22,191	(4,438)	[1,065]	{533}	22,692	(4,538)	[1,089]	{545}
Tarrant	116,931	118,207	119,630	120,899	123,832	(24,766)	[5,944]	{2,972}	126,820	(25,364)	[6,087]	{3,044}	129,862	(25,972)	[6,233]	{3,117}
Travis	41,901	42,136	42,441	42,856	43,586	(8,717)	[2,092]	{1,046}	44,345	(8,869)	[2,129]	{1,064}	45,135	(9,027)	[2,166]	{1,083}
Williamson	16,858	17,129	17,129	17,129	17,692	(3,538)	[849]	{425}	18,291	(3,658)	[878]	{439}	18,929	(3,786)	[909]	{454}

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.