

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 12/13/21**

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 12/13/21 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.

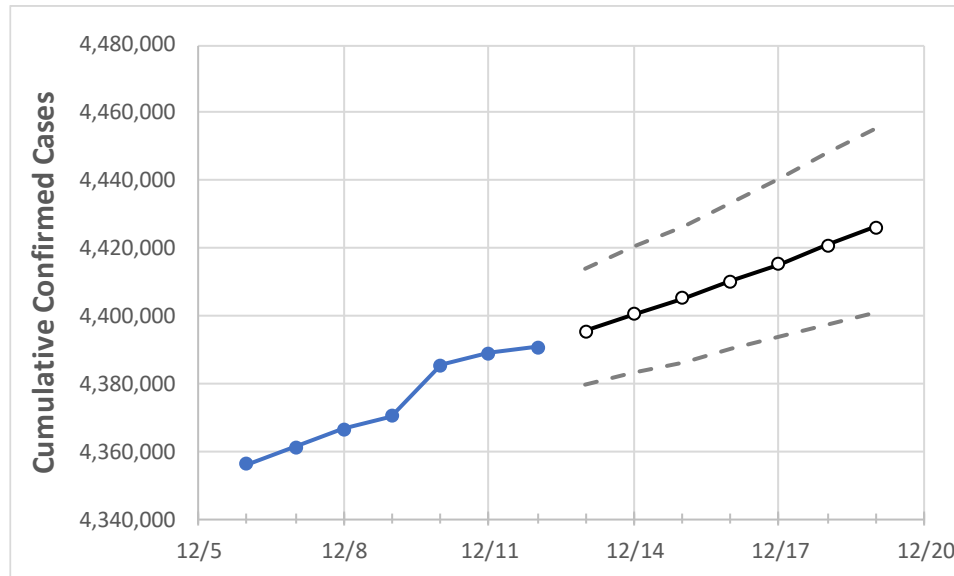
IEM's Modeling Lead

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:						
	12/9	12/10	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19
Texas	4,370,210	4,385,287	4,388,923	4,390,761	4,395,507	4,400,501	4,405,315	4,410,136	4,415,273	4,420,819	4,426,073

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:						
	12/9	12/10	12/11	12/12	12/13	12/14	12/15	12/16	12/17	12/18	12/19
Bexar	329,978	330,287	330,618	330,779	331,048	331,328	331,601	331,892	332,171	332,471	332,762
Brazoria	61,099	61,377	61,440	61,491	61,544	61,597	61,643	61,698	61,754	61,808	61,863
Brazos	39,274	39,302	39,302	39,302	39,324	39,347	39,370	39,394	39,417	39,442	39,465
Collin	133,928	134,856	135,010	135,099	135,286	135,465	135,659	135,869	136,060	136,276	136,477
Dallas	417,081	421,330	421,625	421,838	422,543	423,277	424,110	424,877	425,749	426,743	427,623
Denton	112,396	112,576	112,576	112,576	112,738	112,905	113,067	113,243	113,412	113,584	113,764
El Paso	162,139	163,499	163,961	164,160	164,517	164,891	165,244	165,593	165,970	166,360	166,719
Ellis	34,233	34,380	34,413	34,424	34,455	34,486	34,519	34,556	34,589	34,628	34,668
Fort Bend	103,600	103,670	103,670	103,670	103,809	103,964	104,115	104,278	104,447	104,606	104,780
Galveston	65,463	65,727	65,752	65,793	65,834	65,873	65,914	65,954	65,998	66,044	66,083
Harris	589,735	590,160	590,783	591,083	591,506	591,931	592,368	592,818	593,244	593,707	594,171
Hidalgo	120,542	120,542	120,542	120,542	120,795	121,042	121,300	121,576	121,859	122,171	122,504
Johnson	29,508	29,678	29,721	29,731	29,770	29,810	29,852	29,891	29,933	29,977	30,019
Lubbock	68,469	68,941	69,046	69,071	69,191	69,314	69,426	69,546	69,673	69,808	69,933
McLennan	43,320	43,459	43,477	43,499	43,535	43,565	43,597	43,628	43,665	43,697	43,731
Montgomery	89,722	90,120	90,209	90,255	90,322	90,387	90,455	90,513	90,589	90,659	90,737
Tarrant	374,827	375,279	375,279	375,279	375,719	376,147	376,571	377,047	377,511	377,996	378,490
Travis	123,854	123,993	124,041	124,089	124,212	124,348	124,480	124,611	124,755	124,903	125,050
Williamson	79,636	79,725	79,804	79,869	79,951	80,031	80,113	80,195	80,277	80,361	80,442

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:											
	12/9	12/10	12/11	12/12	12/14			12/16			12/18					
Bexar	329,978	330,287	330,618	330,779	331,328	(66,266)	[15,904]	{7,952}	331,892	(66,378)	[15,931]	{7,965}	332,471	(66,494)	[15,959]	{7,979}
Brazoria	61,099	61,377	61,440	61,491	61,597	(12,319)	[2,957]	{1,478}	61,698	(12,340)	[2,962]	{1,481}	61,808	(12,362)	[2,967]	{1,483}
Brazos	39,274	39,302	39,302	39,302	39,347	(7,869)	[1,889]	{944}	39,394	(7,879)	[1,891]	{945}	39,442	(7,888)	[1,893]	{947}
Collin	133,928	134,856	135,010	135,099	135,465	(27,093)	[6,502]	{3,251}	135,869	(27,174)	[6,522]	{3,261}	136,276	(27,255)	[6,541]	{3,271}
Dallas	417,081	421,330	421,625	421,838	423,277	(84,655)	[20,317]	{10,159}	424,877	(84,975)	[20,394]	{10,197}	426,743	(85,349)	[20,484]	{10,242}
Denton	112,396	112,576	112,576	112,576	112,905	(22,581)	[5,419]	{2,710}	113,243	(22,649)	[5,436]	{2,718}	113,584	(22,717)	[5,452]	{2,726}
El Paso	162,139	163,499	163,961	164,160	164,891	(32,978)	[7,915]	{3,957}	165,593	(33,119)	[7,948]	{3,974}	166,360	(33,272)	[7,985]	{3,993}
Ellis	34,233	34,380	34,413	34,424	34,486	(6,897)	[1,655]	{828}	34,556	(6,911)	[1,659]	{829}	34,628	(6,926)	[1,662]	{831}
Fort Bend	103,600	103,670	103,670	103,670	103,964	(20,793)	[4,990]	{2,495}	104,278	(20,856)	[5,005]	{2,503}	104,606	(20,921)	[5,021]	{2,511}
Galveston	65,463	65,727	65,752	65,793	65,873	(13,175)	[3,162]	{1,581}	65,954	(13,191)	[3,166]	{1,583}	66,044	(13,209)	[3,170]	{1,585}
Harris	589,735	590,160	590,783	591,083	591,931	(118,386)	[28,413]	{14,206}	592,818	(118,564)	[28,455]	{14,228}	593,707	(118,741)	[28,498]	{14,249}
Hidalgo	120,542	120,542	120,542	120,542	121,042	(24,208)	[5,810]	{2,905}	121,576	(24,315)	[5,836]	{2,918}	122,171	(24,434)	[5,864]	{2,932}
Johnson	29,508	29,678	29,721	29,731	29,810	(5,962)	[1,431]	{715}	29,891	(5,978)	[1,435]	{717}	29,977	(5,995)	[1,439]	{719}
Lubbock	68,469	68,941	69,046	69,071	69,314	(13,863)	[3,327]	{1,664}	69,546	(13,909)	[3,338]	{1,669}	69,808	(13,962)	[3,351]	{1,675}
McLennan	43,320	43,459	43,477	43,499	43,565	(8,713)	[2,091]	{1,046}	43,628	(8,726)	[2,094]	{1,047}	43,697	(8,739)	[2,097]	{1,049}
Montgomery	89,722	90,120	90,209	90,255	90,387	(18,077)	[4,339]	{2,169}	90,513	(18,103)	[4,345]	{2,172}	90,659	(18,132)	[4,352]	{2,176}
Tarrant	374,827	375,279	375,279	375,279	376,147	(75,229)	[18,055]	{9,028}	377,047	(75,409)	[18,098]	{9,049}	377,996	(75,599)	[18,144]	{9,072}
Travis	123,854	123,993	124,041	124,089	124,348	(24,870)	[5,969]	{2,984}	124,611	(24,922)	[5,981]	{2,991}	124,903	(24,981)	[5,995]	{2,998}
Williamson	79,636	79,725	79,804	79,869	80,031	(16,006)	[3,842]	{1,921}	80,195	(16,039)	[3,849]	{1,925}	80,361	(16,072)	[3,857]	{1,929}

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.