

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

Date: 2/11/21

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 2/11/21 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.

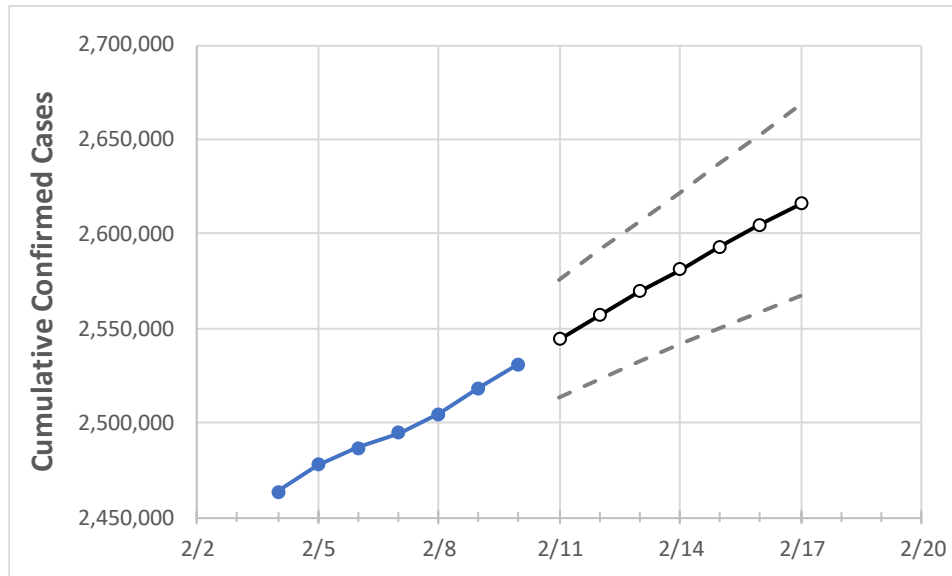
IEM's Modeling Lead

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:						
	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17

Texas 2,494,861 2,504,578 2,518,333 2,531,060 2,544,039 2,556,946 2,569,462 2,581,413 2,593,325 2,605,066 2,616,133

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:						
	2/7	2/8	2/9	2/10	2/11	2/12	2/13	2/14	2/15	2/16	2/17
Bexar	183,201	183,436	184,784	185,444	186,646	187,846	189,008	190,161	191,298	192,401	193,460
Brazoria	30,540	30,363	30,494	30,649	30,841	31,027	31,207	31,388	31,581	31,754	31,931
Brazos	19,626	19,741	19,786	19,917	20,022	20,128	20,232	20,337	20,439	20,538	20,637
Collin	76,772	77,073	77,666	78,080	78,532	78,977	79,400	79,815	80,220	80,612	80,992
Dallas	267,354	268,262	269,565	270,796	271,860	272,879	273,873	274,830	275,759	276,670	277,545
Denton	56,934	57,239	57,919	58,644	59,129	59,607	60,089	60,577	61,066	61,554	62,044
El Paso	116,644	117,039	117,370	117,743	118,137	118,530	118,903	119,274	119,645	120,022	120,391
Ellis	19,568	19,632	19,695	19,813	19,909	20,000	20,091	20,181	20,266	20,351	20,433
Fort Bend	53,043	53,153	53,764	54,233	54,571	54,915	55,257	55,597	55,926	56,246	56,569
Galveston	32,106	32,212	32,317	32,476	32,640	32,802	32,957	33,102	33,248	33,391	33,531
Harris	328,426	329,167	329,576	330,256	331,342	332,405	333,396	334,349	335,273	336,146	336,998
Hidalgo	68,247	68,586	69,257	69,765	70,358	70,971	71,586	72,194	72,827	73,470	74,129
Johnson	17,441	17,489	17,536	17,663	17,754	17,841	17,927	18,011	18,095	18,173	18,251
Lubbock	47,418	47,436	47,474	47,530	47,588	47,643	47,697	47,751	47,802	47,850	47,897
McLennan	23,600	23,624	23,826	23,953	24,007	24,061	24,116	24,169	24,216	24,265	24,315
Montgomery	41,669	41,848	42,261	42,477	42,706	42,928	43,146	43,360	43,569	43,766	43,958
Tarrant	228,038	230,088	230,981	232,292	233,567	234,812	236,014	237,196	238,371	239,534	240,639
Travis	71,831	72,279	72,625	72,972	73,345	73,706	74,058	74,402	74,743	75,070	75,401
Williamson	38,399	38,542	38,913	39,073	39,320	39,560	39,791	40,018	40,244	40,458	40,670

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:											
	2/7	2/8	2/9	2/10	2/12			2/14			2/16					
Bexar	183,201	183,436	184,784	185,444	187,846	(37,569)	[9,017]	{4,508}	190,161	(38,032)	[9,128]	{4,564}	192,401	(38,480)	[9,235]	{4,618}
Brazoria	30,540	30,363	30,494	30,649	31,027	(6,205)	[1,489]	{745}	31,388	(6,278)	[1,507]	{753}	31,754	(6,351)	[1,524]	{762}
Brazos	19,626	19,741	19,786	19,917	20,128	(4,026)	[966]	{483}	20,337	(4,067)	[976]	{488}	20,538	(4,108)	[986]	{493}
Collin	76,772	77,073	77,666	78,080	78,977	(15,795)	[3,791]	{1,895}	79,815	(15,963)	[3,831]	{1,916}	80,612	(16,122)	[3,869]	{1,935}
Dallas	267,354	268,262	269,565	270,796	272,879	(54,576)	[13,098]	{6,549}	274,830	(54,966)	[13,192]	{6,596}	276,670	(55,334)	[13,280]	{6,640}
Denton	56,934	57,239	57,919	58,644	59,607	(11,921)	[2,861]	{1,431}	60,577	(12,115)	[2,908]	{1,454}	61,554	(12,311)	[2,955]	{1,477}
El Paso	116,644	117,039	117,370	117,743	118,530	(23,706)	[5,689]	{2,845}	119,274	(23,855)	[5,725]	{2,863}	120,022	(24,004)	[5,761]	{2,881}
Ellis	19,568	19,632	19,695	19,813	20,000	(4,000)	[960]	{480}	20,181	(4,036)	[969]	{484}	20,351	(4,070)	[977]	{488}
Fort Bend	53,043	53,153	53,764	54,233	54,915	(10,983)	[2,636]	{1,318}	55,597	(11,119)	[2,669]	{1,334}	56,246	(11,249)	[2,700]	{1,350}
Galveston	32,106	32,212	32,317	32,476	32,802	(6,560)	[1,574]	{787}	33,102	(6,620)	[1,589]	{794}	33,391	(6,678)	[1,603]	{801}
Harris	328,426	329,167	329,576	330,256	332,405	(66,481)	[15,955]	{7,978}	334,349	(66,870)	[16,049]	{8,024}	336,146	(67,229)	[16,135]	{8,068}
Hidalgo	68,247	68,586	69,257	69,765	70,971	(14,194)	[3,407]	{1,703}	72,194	(14,439)	[3,465]	{1,733}	73,470	(14,694)	[3,527]	{1,763}
Johnson	17,441	17,489	17,536	17,663	17,841	(3,568)	[856]	{428}	18,011	(3,602)	[865]	{432}	18,173	(3,635)	[872]	{436}
Lubbock	47,418	47,436	47,474	47,530	47,643	(9,529)	[2,287]	{1,143}	47,751	(9,550)	[2,292]	{1,146}	47,850	(9,570)	[2,297]	{1,148}
McLennan	23,600	23,624	23,826	23,953	24,061	(4,812)	[1,155]	{577}	24,169	(4,834)	[1,160]	{580}	24,265	(4,853)	[1,165]	{582}
Montgomery	41,669	41,848	42,261	42,477	42,928	(8,586)	[2,061]	{1,030}	43,360	(8,672)	[2,081]	{1,041}	43,766	(8,753)	[2,101]	{1,050}
Tarrant	228,038	230,088	230,981	232,292	234,812	(46,962)	[11,271]	{5,635}	237,196	(47,439)	[11,385]	{5,693}	239,534	(47,907)	[11,498]	{5,749}
Travis	71,831	72,279	72,625	72,972	73,706	(14,741)	[3,538]	{1,769}	74,402	(14,880)	[3,571]	{1,786}	75,070	(15,014)	[3,603]	{1,802}
Williamson	38,399	38,542	38,913	39,073	39,560	(7,912)	[1,899]	{949}	40,018	(8,004)	[1,921]	{960}	40,458	(8,092)	[1,942]	{971}

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.