

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

Date: 4/16/21

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 4/16/21 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.

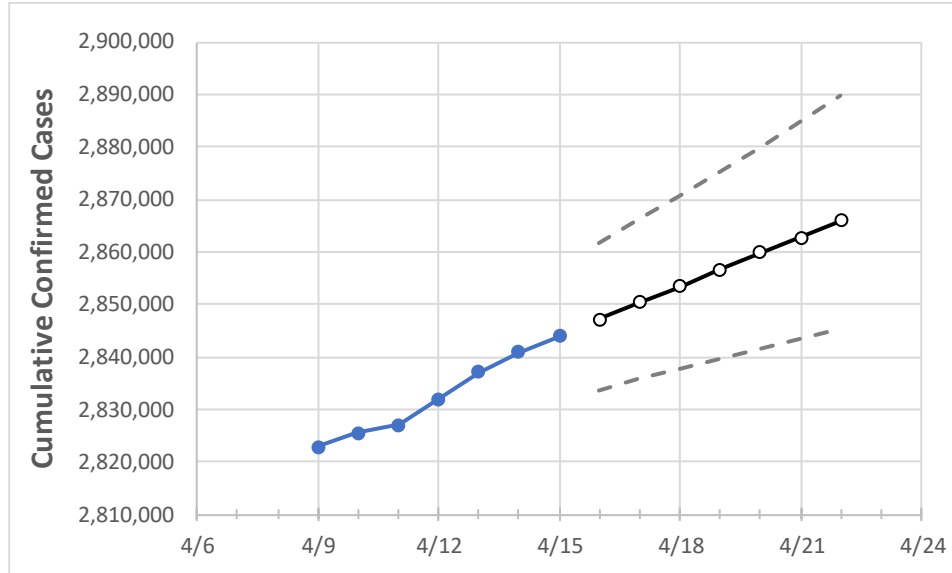
IEM's Modeling Lead

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:							
	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	4/21	4/22	
Texas	2,831,972	2,837,160	2,840,869	2,843,929	2,847,106	2,850,333	2,853,474	2,856,627	2,859,791	2,862,815	2,865,982	

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:							
	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	4/21	4/22	
Bexar	210,796	211,069	211,321	211,397	211,781	212,174	212,570	212,982	213,401	213,809	214,231	
Brazoria	36,222	36,323	36,374	36,422	36,474	36,525	36,577	36,630	36,679	36,730	36,780	
Brazos	25,555	25,579	25,642	25,646	25,671	25,695	25,719	25,742	25,764	25,784	25,803	
Collin	87,845	87,982	88,017	88,074	88,162	88,251	88,339	88,426	88,512	88,598	88,684	
Dallas	294,386	294,612	294,897	295,099	295,328	295,554	295,784	295,999	296,215	296,431	296,644	
Denton	72,779	72,928	73,005	73,082	73,150	73,215	73,281	73,345	73,409	73,472	73,533	
El Paso	131,459	131,561	131,746	131,898	132,051	132,204	132,357	132,511	132,665	132,822	132,976	
Ellis	22,293	22,314	22,334	22,349	22,364	22,380	22,395	22,411	22,426	22,443	22,457	
Fort Bend	64,506	64,901	65,124	65,275	65,409	65,541	65,669	65,799	65,933	66,058	66,191	
Galveston	37,874	37,941	38,012	38,056	38,116	38,176	38,235	38,294	38,354	38,413	38,471	
Harris	383,325	383,709	384,358	384,934	385,419	385,910	386,388	386,872	387,346	387,799	388,270	
Hidalgo	86,167	86,339	86,542	86,760	86,862	86,964	87,063	87,162	87,259	87,358	87,451	
Johnson	19,461	19,477	19,482	19,493	19,502	19,511	19,519	19,528	19,536	19,544	19,552	
Lubbock	48,702	48,710	48,725	48,732	48,742	48,751	48,760	48,769	48,778	48,787	48,796	
McLennan	26,386	26,406	26,439	26,473	26,496	26,519	26,541	26,563	26,584	26,606	26,628	
Montgomery	50,660	50,740	50,866	50,915	51,006	51,098	51,189	51,281	51,370	51,459	51,548	
Tarrant	253,211	253,402	253,672	253,954	254,163	254,373	254,598	254,818	255,037	255,259	255,479	
Travis	80,533	80,642	80,799	80,909	81,038	81,170	81,305	81,444	81,581	81,722	81,866	
Williamson	44,077	44,167	44,277	44,322	44,397	44,473	44,550	44,631	44,711	44,792	44,870	

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:											
	4/12	4/13	4/14	4/15	4/17				4/19				4/21			
Bexar	210,796	211,069	211,321	211,397	212,174	(42,435)	[10,184]	{5,092}	212,982	(42,596)	[10,223]	{5,112}	213,809	(42,762)	[10,263]	{5,131}
Brazoria	36,222	36,323	36,374	36,422	36,525	(7,305)	[1,753]	{877}	36,630	(7,326)	[1,758]	{879}	36,730	(7,346)	[1,763]	{882}
Brazos	25,555	25,579	25,642	25,646	25,695	(5,139)	[1,233]	{617}	25,742	(5,148)	[1,236]	{618}	25,784	(5,157)	[1,238]	{619}
Collin	87,845	87,982	88,017	88,074	88,251	(17,650)	[4,236]	{2,118}	88,426	(17,685)	[4,244]	{2,122}	88,598	(17,720)	[4,253]	{2,126}
Dallas	294,386	294,612	294,897	295,099	295,554	(59,111)	[14,187]	{7,093}	295,999	(59,200)	[14,208]	{7,104}	296,431	(59,286)	[14,229]	{7,114}
Denton	72,779	72,928	73,005	73,082	73,215	(14,643)	[3,514]	{1,757}	73,345	(14,669)	[3,521]	{1,760}	73,472	(14,694)	[3,527]	{1,763}
El Paso	131,459	131,561	131,746	131,898	132,204	(26,441)	[6,346]	{3,173}	132,511	(26,502)	[6,361]	{3,180}	132,822	(26,564)	[6,375]	{3,188}
Ellis	22,293	22,314	22,334	22,349	22,380	(4,476)	[1,074]	{537}	22,411	(4,482)	[1,076]	{538}	22,443	(4,489)	[1,077]	{539}
Fort Bend	64,506	64,901	65,124	65,275	65,541	(13,108)	[3,146]	{1,573}	65,799	(13,160)	[3,158]	{1,579}	66,058	(13,212)	[3,171]	{1,585}
Galveston	37,874	37,941	38,012	38,056	38,176	(7,635)	[1,832]	{916}	38,294	(7,659)	[1,838]	{919}	38,413	(7,683)	[1,844]	{922}
Harris	383,325	383,709	384,358	384,934	385,910	(77,182)	[18,524]	{9,262}	386,872	(77,374)	[18,570]	{9,285}	387,799	(77,560)	[18,614]	{9,307}
Hidalgo	86,167	86,339	86,542	86,760	86,964	(17,393)	[4,174]	{2,087}	87,162	(17,432)	[4,184]	{2,092}	87,358	(17,472)	[4,193]	{2,097}
Johnson	19,461	19,477	19,482	19,493	19,511	(3,902)	[937]	{468}	19,528	(3,906)	[937]	{469}	19,544	(3,909)	[938]	{469}
Lubbock	48,702	48,710	48,725	48,732	48,751	(9,750)	[2,340]	{1,170}	48,769	(9,754)	[2,341]	{1,170}	48,787	(9,757)	[2,342]	{1,171}
McLennan	26,386	26,406	26,439	26,473	26,519	(5,304)	[1,273]	{636}	26,563	(5,313)	[1,275]	{638}	26,606	(5,321)	[1,277]	{639}
Montgomery	50,660	50,740	50,866	50,915	51,098	(10,220)	[2,453]	{1,226}	51,281	(10,256)	[2,461]	{1,231}	51,459	(10,292)	[2,470]	{1,235}
Tarrant	253,211	253,402	253,672	253,954	254,373	(50,875)	[12,210]	{6,105}	254,818	(50,964)	[12,231]	{6,116}	255,259	(51,052)	[12,252]	{6,126}
Travis	80,533	80,642	80,799	80,909	81,170	(16,234)	[3,896]	{1,948}	81,444	(16,289)	[3,909]	{1,955}	81,722	(16,344)	[3,923]	{1,961}
Williamson	44,077	44,167	44,277	44,322	44,473	(8,895)	[2,135]	{1,067}	44,631	(8,926)	[2,142]	{1,071}	44,792	(8,958)	[2,150]	{1,075}

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.