

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

Date: 4/15/21

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 4/15/21 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.

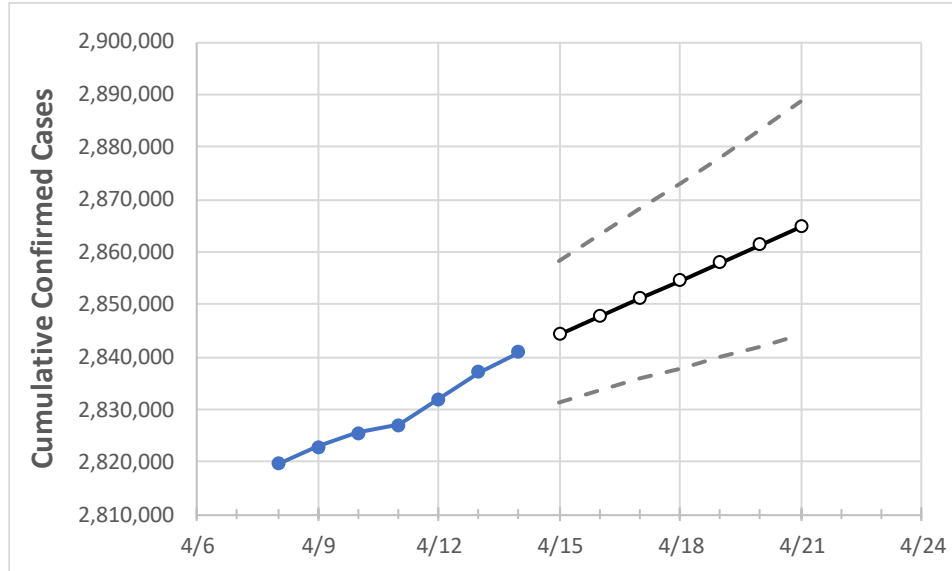
IEM's Modeling Lead

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:							
	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	4/21	
Texas	2,826,977	2,831,972	2,837,160	2,840,869	2,844,252	2,847,699	2,851,110	2,854,516	2,857,965	2,861,343	2,864,820	

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:							
	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	4/21	
Bexar	210,148	210,796	211,069	211,321	211,771	212,229	212,688	213,169	213,628	214,105	214,599	
Brazoria	36,152	36,222	36,323	36,374	36,429	36,485	36,542	36,595	36,645	36,702	36,757	
Brazos	25,531	25,555	25,579	25,642	25,670	25,698	25,725	25,751	25,776	25,802	25,826	
Collin	87,709	87,845	87,982	88,017	88,112	88,206	88,303	88,399	88,492	88,582	88,675	
Dallas	294,160	294,386	294,612	294,897	295,129	295,364	295,598	295,830	296,049	296,272	296,487	
Denton	72,714	72,779	72,928	72,928	72,991	73,054	73,113	73,171	73,231	73,288	73,340	
El Paso	131,283	131,459	131,561	131,746	131,904	132,061	132,218	132,379	132,537	132,693	132,849	
Ellis	22,273	22,293	22,314	22,334	22,351	22,368	22,385	22,402	22,418	22,435	22,452	
Fort Bend	64,473	64,506	64,901	65,124	65,236	65,353	65,469	65,577	65,687	65,804	65,918	
Galveston	37,807	37,874	37,941	38,012	38,074	38,136	38,197	38,259	38,321	38,382	38,443	
Harris	382,779	383,325	383,709	384,358	384,837	385,314	385,777	386,233	386,701	387,138	387,582	
Hidalgo	86,137	86,167	86,339	86,542	86,629	86,716	86,799	86,883	86,959	87,036	87,114	
Johnson	19,445	19,461	19,477	19,482	19,492	19,501	19,510	19,519	19,528	19,536	19,543	
Lubbock	48,695	48,702	48,710	48,725	48,735	48,744	48,754	48,764	48,773	48,783	48,792	
McLennan	26,367	26,386	26,406	26,439	26,460	26,481	26,503	26,523	26,544	26,564	26,582	
Montgomery	50,536	50,660	50,740	50,866	50,958	51,049	51,141	51,232	51,322	51,411	51,499	
Tarrant	252,872	253,211	253,402	253,672	253,875	254,088	254,298	254,513	254,728	254,943	255,165	
Travis	80,446	80,533	80,642	80,799	80,923	81,051	81,180	81,312	81,443	81,579	81,715	
Williamson	43,995	44,077	44,167	44,277	44,361	44,447	44,533	44,622	44,711	44,803	44,896	

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:											
	4/11	4/12	4/13	4/14	4/16				4/18				4/20			
Bexar	210,148	210,796	211,069	211,321	212,229	(42,446)	[10,187]	{5,093}	213,169	(42,634)	[10,232]	{5,116}	214,105	(42,821)	[10,277]	{5,139}
Brazoria	36,152	36,222	36,323	36,374	36,485	(7,297)	[1,751]	{876}	36,595	(7,319)	[1,757]	{878}	36,702	(7,340)	[1,762]	{881}
Brazos	25,531	25,555	25,579	25,642	25,698	(5,140)	[1,233]	{617}	25,751	(5,150)	[1,236]	{618}	25,802	(5,160)	[1,238]	{619}
Collin	87,709	87,845	87,982	88,017	88,206	(17,641)	[4,234]	{2,117}	88,399	(17,680)	[4,243]	{2,122}	88,582	(17,716)	[4,252]	{2,126}
Dallas	294,160	294,386	294,612	294,897	295,364	(59,073)	[14,177]	{7,089}	295,830	(59,166)	[14,200]	{7,100}	296,272	(59,254)	[14,221]	{7,111}
Denton	72,714	72,779	72,928	72,928	73,054	(14,611)	[3,507]	{1,753}	73,171	(14,634)	[3,512]	{1,756}	73,288	(14,658)	[3,518]	{1,759}
El Paso	131,283	131,459	131,561	131,746	132,061	(26,412)	[6,339]	{3,169}	132,379	(26,476)	[6,354]	{3,177}	132,693	(26,539)	[6,369]	{3,185}
Ellis	22,273	22,293	22,314	22,334	22,368	(4,474)	[1,074]	{537}	22,402	(4,480)	[1,075]	{538}	22,435	(4,487)	[1,077]	{538}
Fort Bend	64,473	64,506	64,901	65,124	65,353	(13,071)	[3,137]	{1,568}	65,577	(13,115)	[3,148]	{1,574}	65,804	(13,161)	[3,159]	{1,579}
Galveston	37,807	37,874	37,941	38,012	38,136	(7,627)	[1,831]	{915}	38,259	(7,652)	[1,836]	{918}	38,382	(7,676)	[1,842]	{921}
Harris	382,779	383,325	383,709	384,358	385,314	(77,063)	[18,495]	{9,248}	386,233	(77,247)	[18,539]	{9,270}	387,138	(77,428)	[18,583]	{9,291}
Hidalgo	86,137	86,167	86,339	86,542	86,716	(17,343)	[4,162]	{2,081}	86,883	(17,377)	[4,170]	{2,085}	87,036	(17,407)	[4,178]	{2,089}
Johnson	19,445	19,461	19,477	19,482	19,501	(3,900)	[936]	{468}	19,519	(3,904)	[937]	{468}	19,536	(3,907)	[938]	{469}
Lubbock	48,695	48,702	48,710	48,725	48,744	(9,749)	[2,340]	{1,170}	48,764	(9,753)	[2,341]	{1,170}	48,783	(9,757)	[2,342]	{1,171}
McLennan	26,367	26,386	26,406	26,439	26,481	(5,296)	[1,271]	{636}	26,523	(5,305)	[1,273]	{637}	26,564	(5,313)	[1,275]	{638}
Montgomery	50,536	50,660	50,740	50,866	51,049	(10,210)	[2,450]	{1,225}	51,232	(10,246)	[2,459]	{1,230}	51,411	(10,282)	[2,468]	{1,234}
Tarrant	252,872	253,211	253,402	253,672	254,088	(50,818)	[12,196]	{6,098}	254,513	(50,903)	[12,217]	{6,108}	254,943	(50,989)	[12,237]	{6,119}
Travis	80,446	80,533	80,642	80,799	81,051	(16,210)	[3,890]	{1,945}	81,312	(16,262)	[3,903]	{1,951}	81,579	(16,316)	[3,916]	{1,958}
Williamson	43,995	44,077	44,167	44,277	44,447	(8,889)	[2,133]	{1,067}	44,622	(8,924)	[2,142]	{1,071}	44,803	(8,961)	[2,151]	{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.