

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

Date: 4/5/21

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 4/5/21 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.

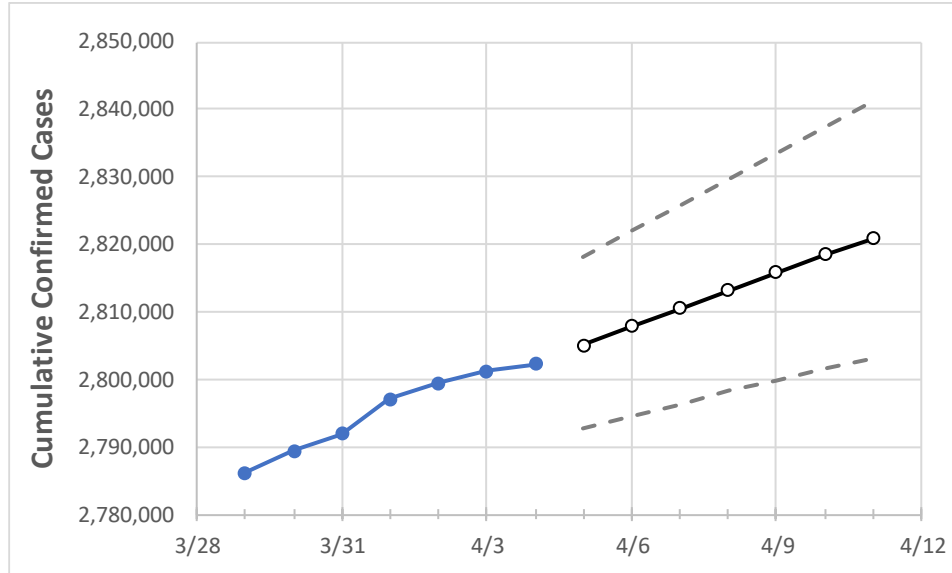
IEM's Modeling Lead

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:						
	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11
Texas	2,797,010	2,799,375	2,801,218	2,802,225	2,804,985	2,807,793	2,810,497	2,813,206	2,815,865	2,818,427	2,820,927

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:							
	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8	4/9	4/10	4/11	
Bexar	205,777	205,777	205,777	205,777	206,120	206,461	206,797	207,169	207,544	207,898	208,268	
Brazoria	35,579	35,604	35,605	35,737	35,794	35,848	35,900	35,953	36,007	36,057	36,107	
Brazos	25,189	25,233	25,233	25,233	25,292	25,350	25,409	25,467	25,525	25,579	25,636	
Collin	86,787	86,867	86,904	87,043	87,147	87,252	87,355	87,461	87,566	87,671	87,774	
Dallas	291,589	291,859	292,153	292,153	292,489	292,820	293,150	293,479	293,825	294,165	294,495	
Denton	71,976	71,976	71,976	71,976	72,029	72,077	72,123	72,169	72,211	72,251	72,288	
El Paso	129,723	129,884	130,026	130,102	130,241	130,378	130,512	130,643	130,777	130,906	131,037	
Ellis	22,172	22,201	22,164	22,164	22,183	22,202	22,220	22,238	22,256	22,274	22,292	
Fort Bend	63,440	63,440	63,440	63,440	63,556	63,669	63,781	63,888	64,002	64,114	64,226	
Galveston	37,190	37,261	37,310	37,358	37,413	37,468	37,523	37,576	37,629	37,681	37,732	
Harris	377,720	378,299	379,022	379,461	380,105	380,752	381,396	382,021	382,660	383,306	383,948	
Hidalgo	85,141	85,141	85,141	85,141	85,263	85,375	85,485	85,597	85,704	85,815	85,912	
Johnson	19,334	19,351	19,361	19,361	19,380	19,399	19,418	19,437	19,456	19,475	19,493	
Lubbock	48,591	48,608	48,610	48,610	48,621	48,632	48,643	48,653	48,664	48,674	48,684	
McLennan	26,122	26,164	26,164	26,164	26,194	26,225	26,255	26,286	26,316	26,345	26,375	
Montgomery	49,605	49,605	49,605	49,605	49,721	49,838	49,954	50,068	50,183	50,293	50,410	
Tarrant	251,106	251,106	251,106	251,106	251,284	251,453	251,624	251,785	251,945	252,107	252,252	
Travis	79,324	79,422	79,493	79,493	79,587	79,681	79,773	79,864	79,958	80,050	80,144	
Williamson	43,275	43,275	43,275	43,275	43,350	43,425	43,500	43,573	43,652	43,727	43,804	

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:											
	4/1	4/2	4/3	4/4	4/6				4/8				4/10			
Bexar	205,777	205,777	205,777	205,777	206,461	(41,292)	[9,910]	{4,955}	207,169	(41,434)	[9,944]	{4,972}	207,898	(41,580)	[9,979]	{4,990}
Brazoria	35,579	35,604	35,605	35,737	35,848	(7,170)	[1,721]	{860}	35,953	(7,191)	[1,726]	{863}	36,057	(7,211)	[1,731]	{865}
Brazos	25,189	25,233	25,233	25,233	25,350	(5,070)	[1,217]	{608}	25,467	(5,093)	[1,222]	{611}	25,579	(5,116)	[1,228]	{614}
Collin	86,787	86,867	86,904	87,043	87,252	(17,450)	[4,188]	{2,094}	87,461	(17,492)	[4,198]	{2,099}	87,671	(17,534)	[4,208]	{2,104}
Dallas	291,589	291,859	292,153	292,153	292,820	(58,564)	[14,055]	{7,028}	293,479	(58,696)	[14,087]	{7,043}	294,165	(58,833)	[14,120]	{7,060}
Denton	71,976	71,976	71,976	71,976	72,077	(14,415)	[3,460]	{1,730}	72,169	(14,434)	[3,464]	{1,732}	72,251	(14,450)	[3,468]	{1,734}
El Paso	129,723	129,884	130,026	130,102	130,378	(26,076)	[6,258]	{3,129}	130,643	(26,129)	[6,271]	{3,135}	130,906	(26,181)	[6,283]	{3,142}
Ellis	22,172	22,201	22,164	22,164	22,202	(4,440)	[1,066]	{533}	22,238	(4,448)	[1,067]	{534}	22,274	(4,455)	[1,069]	{535}
Fort Bend	63,440	63,440	63,440	63,440	63,669	(12,734)	[3,056]	{1,528}	63,888	(12,778)	[3,067]	{1,533}	64,114	(12,823)	[3,077]	{1,539}
Galveston	37,190	37,261	37,310	37,358	37,468	(7,494)	[1,798]	{899}	37,576	(7,515)	[1,804]	{902}	37,681	(7,536)	[1,809]	{904}
Harris	377,720	378,299	379,022	379,461	380,752	(76,150)	[18,276]	{9,138}	382,021	(76,404)	[18,337]	{9,169}	383,306	(76,661)	[18,399]	{9,199}
Hidalgo	85,141	85,141	85,141	85,141	85,375	(17,075)	[4,098]	{2,049}	85,597	(17,119)	[4,109]	{2,054}	85,815	(17,163)	[4,119]	{2,060}
Johnson	19,334	19,351	19,361	19,361	19,399	(3,880)	[931]	{466}	19,437	(3,887)	[933]	{466}	19,475	(3,895)	[935]	{467}
Lubbock	48,591	48,608	48,610	48,610	48,632	(9,726)	[2,334]	{1,167}	48,653	(9,731)	[2,335]	{1,168}	48,674	(9,735)	[2,336]	{1,168}
McLennan	26,122	26,164	26,164	26,164	26,225	(5,245)	[1,259]	{629}	26,286	(5,257)	[1,262]	{631}	26,345	(5,269)	[1,265]	{632}
Montgomery	49,605	49,605	49,605	49,605	49,838	(9,968)	[2,392]	{1,196}	50,068	(10,014)	[2,403]	{1,202}	50,293	(10,059)	[2,414]	{1,207}
Tarrant	251,106	251,106	251,106	251,106	251,453	(50,291)	[12,070]	{6,035}	251,785	(50,357)	[12,086]	{6,043}	252,107	(50,421)	[12,101]	{6,051}
Travis	79,324	79,422	79,493	79,493	79,681	(15,936)	[3,825]	{1,912}	79,864	(15,973)	[3,833]	{1,917}	80,050	(16,010)	[3,842]	{1,921}
Williamson	43,275	43,275	43,275	43,275	43,425	(8,685)	[2,084]	{1,042}	43,573	(8,715)	[2,092]	{1,046}	43,727	(8,745)	[2,099]	{1,049}

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.