

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

Date: 4/12/21

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 4/12/21 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.**

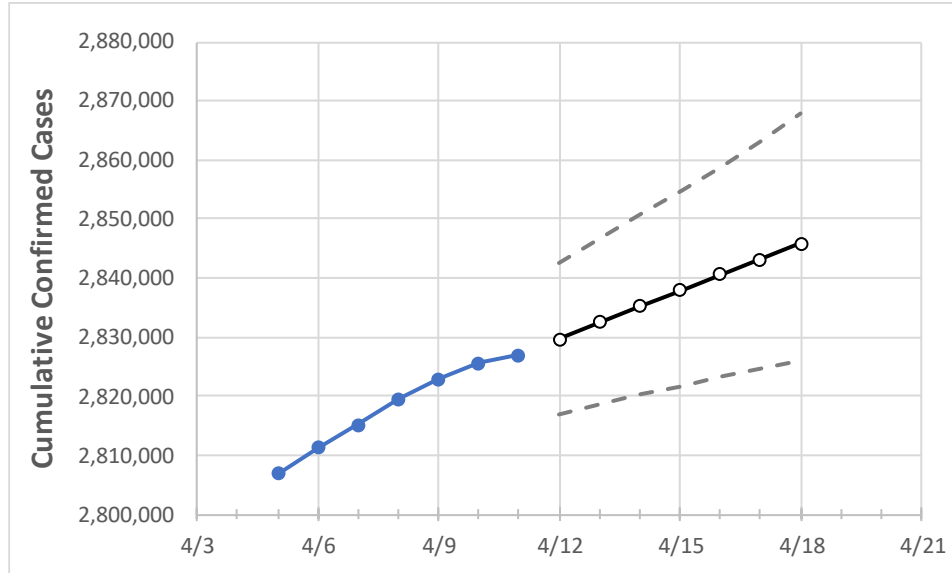
### IEM's Modeling Lead

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:						
	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18
Texas	2,819,600	2,822,889	2,825,551	2,826,977	2,829,706	2,832,477	2,835,146	2,837,881	2,840,629	2,843,200	2,845,823

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:						
	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18
Bexar	208,606	208,852	208,852	208,852	209,199	209,549	209,909	210,267	210,642	211,004	211,367
Brazoria	35,970	36,043	36,134	36,152	36,200	36,250	36,298	36,345	36,396	36,445	36,491
Brazos	25,408	25,464	25,507	25,507	25,537	25,566	25,594	25,621	25,647	25,673	25,695
Collin	87,422	87,486	87,634	87,709	87,806	87,904	88,000	88,093	88,187	88,282	88,379
Dallas	293,150	293,659	293,934	293,934	294,192	294,442	294,698	294,947	295,194	295,444	295,682
Denton	72,498	72,583	72,583	72,583	72,646	72,708	72,768	72,827	72,882	72,937	72,991
El Paso	130,875	131,004	131,159	131,283	131,442	131,603	131,758	131,914	132,073	132,234	132,397
Ellis	22,223	22,237	22,252	22,252	22,268	22,284	22,299	22,315	22,330	22,346	22,360
Fort Bend	64,271	64,407	64,407	64,407	64,527	64,645	64,759	64,873	64,993	65,118	65,238
Galveston	37,590	37,691	37,747	37,807	37,867	37,927	37,988	38,049	38,110	38,168	38,229
Harris	381,221	381,664	382,209	382,779	383,243	383,697	384,143	384,570	384,990	385,402	385,797
Hidalgo	85,899	86,076	86,076	86,076	86,181	86,282	86,377	86,476	86,576	86,670	86,756
Johnson	19,411	19,424	19,429	19,429	19,440	19,450	19,460	19,470	19,479	19,487	19,496
Lubbock	48,671	48,678	48,687	48,687	48,697	48,707	48,717	48,727	48,737	48,746	48,756
McLennan	26,297	26,324	26,347	26,347	26,367	26,387	26,407	26,427	26,446	26,465	26,483
Montgomery	50,184	50,287	50,287	50,287	50,364	50,440	50,515	50,589	50,662	50,734	50,803
Tarrant	252,461	252,669	252,771	252,872	253,043	253,210	253,379	253,548	253,707	253,872	254,040
Travis	80,031	80,132	80,272	80,446	80,575	80,705	80,838	80,973	81,110	81,252	81,396
Williamson	43,748	43,832	43,832	43,832	43,908	43,984	44,060	44,139	44,216	44,294	44,375

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:											
	4/8	4/9	4/10	4/11	4/13				4/15				4/17			
Bexar	208,606	208,852	208,852	208,852	209,549	(41,910)	[10,058]	{5,029}	210,267	(42,053)	[10,093]	{5,046}	211,004	(42,201)	[10,128]	{5,064}
Brazoria	35,970	36,043	36,134	36,152	36,250	(7,250)	[1,740]	{870}	36,345	(7,269)	[1,745]	{872}	36,445	(7,289)	[1,749]	{875}
Brazos	25,408	25,464	25,507	25,507	25,566	(5,113)	[1,227]	{614}	25,621	(5,124)	[1,230]	{615}	25,673	(5,135)	[1,232]	{616}
Collin	87,422	87,486	87,634	87,709	87,904	(17,581)	[4,219]	{2,110}	88,093	(17,619)	[4,228]	{2,114}	88,282	(17,656)	[4,238]	{2,119}
Dallas	293,150	293,659	293,934	293,934	294,442	(58,888)	[14,133]	{7,067}	294,947	(58,989)	[14,157]	{7,079}	295,444	(59,089)	[14,181]	{7,091}
Denton	72,498	72,583	72,583	72,583	72,708	(14,542)	[3,490]	{1,745}	72,827	(14,565)	[3,496]	{1,748}	72,937	(14,587)	[3,501]	{1,750}
El Paso	130,875	131,004	131,159	131,283	131,603	(26,321)	[6,317]	{3,158}	131,914	(26,383)	[6,332]	{3,166}	132,234	(26,447)	[6,347]	{3,174}
Ellis	22,223	22,237	22,252	22,252	22,284	(4,457)	[1,070]	{535}	22,315	(4,463)	[1,071]	{536}	22,346	(4,469)	[1,073]	{536}
Fort Bend	64,271	64,407	64,407	64,407	64,645	(12,929)	[3,103]	{1,551}	64,873	(12,975)	[3,114]	{1,557}	65,118	(13,024)	[3,126]	{1,563}
Galveston	37,590	37,691	37,747	37,807	37,927	(7,585)	[1,821]	{910}	38,049	(7,610)	[1,826]	{913}	38,168	(7,634)	[1,832]	{916}
Harris	381,221	381,664	382,209	382,779	383,697	(76,739)	[18,417]	{9,209}	384,570	(76,914)	[18,459]	{9,230}	385,402	(77,080)	[18,499]	{9,250}
Hidalgo	85,899	86,076	86,076	86,076	86,282	(17,256)	[4,142]	{2,071}	86,476	(17,295)	[4,151]	{2,075}	86,670	(17,334)	[4,160]	{2,080}
Johnson	19,411	19,424	19,429	19,429	19,450	(3,890)	[934]	{467}	19,470	(3,894)	[935]	{467}	19,487	(3,897)	[935]	{468}
Lubbock	48,671	48,678	48,687	48,687	48,707	(9,741)	[2,338]	{1,169}	48,727	(9,745)	[2,339]	{1,169}	48,746	(9,749)	[2,340]	{1,170}
McLennan	26,297	26,324	26,347	26,347	26,387	(5,277)	[1,267]	{633}	26,427	(5,285)	[1,268]	{634}	26,465	(5,293)	[1,270]	{635}
Montgomery	50,184	50,287	50,287	50,287	50,440	(10,088)	[2,421]	{1,211}	50,589	(10,118)	[2,428]	{1,214}	50,734	(10,147)	[2,435]	{1,218}
Tarrant	252,461	252,669	252,771	252,872	253,210	(50,642)	[12,154]	{6,077}	253,548	(50,710)	[12,170]	{6,085}	253,872	(50,774)	[12,186]	{6,093}
Travis	80,031	80,132	80,272	80,446	80,705	(16,141)	[3,874]	{1,937}	80,973	(16,195)	[3,887]	{1,943}	81,252	(16,250)	[3,900]	{1,950}
Williamson	43,748	43,832	43,832	43,832	43,984	(8,797)	[2,111]	{1,056}	44,139	(8,828)	[2,119]	{1,059}	44,294	(8,859)	[2,126]	{1,063}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at [bryan.koon@iem.com](mailto:bryan.koon@iem.com) or 850-519-7966 or Stephanie Tennyson at [stephanie.tennyson@iem.com](mailto:stephanie.tennyson@iem.com) or 202-309-4257.