

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

Date: 4/9/21

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 4/9/21 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.**

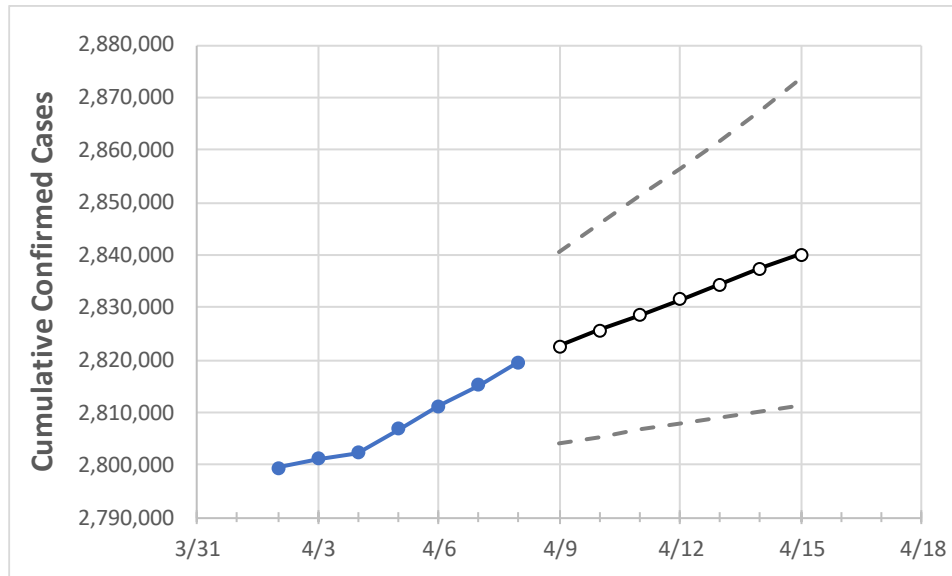
### IEM's Modeling Lead

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:							
	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15	
Texas	2,806,908	2,811,270	2,815,110	2,819,600	2,822,614	2,825,626	2,828,470	2,831,479	2,834,395	2,837,315	2,840,154	

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:							
	4/5	4/6	4/7	4/8	4/9	4/10	4/11	4/12	4/13	4/14	4/15	
Bexar	207,949	208,172	208,462	208,606	208,986	209,368	209,756	210,152	210,555	210,961	211,381	
Brazoria	35,743	35,749	35,918	35,970	36,021	36,070	36,119	36,164	36,216	36,262	36,305	
Brazos	25,265	25,276	25,326	25,408	25,435	25,460	25,485	25,510	25,533	25,554	25,574	
Collin	87,092	87,267	87,275	87,422	87,520	87,618	87,719	87,822	87,919	88,022	88,121	
Dallas	292,364	292,743	293,121	293,150	293,362	293,573	293,773	293,970	294,161	294,346	294,527	
Denton	72,160	72,321	72,422	72,498	72,557	72,618	72,676	72,731	72,785	72,839	72,891	
El Paso	130,250	130,457	130,647	130,875	131,038	131,202	131,371	131,536	131,700	131,869	132,037	
Ellis	22,177	22,183	22,203	22,223	22,239	22,255	22,272	22,288	22,303	22,319	22,334	
Fort Bend	63,656	64,010	64,113	64,271	64,361	64,451	64,538	64,626	64,704	64,791	64,867	
Galveston	37,397	37,436	37,525	37,590	37,645	37,699	37,754	37,806	37,858	37,909	37,959	
Harris	379,684	380,297	380,652	381,221	381,735	382,232	382,706	383,161	383,606	384,031	384,458	
Hidalgo	85,206	85,296	85,628	85,899	85,977	86,056	86,134	86,208	86,277	86,341	86,405	
Johnson	19,375	19,382	19,396	19,411	19,423	19,435	19,446	19,457	19,468	19,478	19,488	
Lubbock	48,635	48,647	48,661	48,671	48,682	48,692	48,703	48,713	48,724	48,735	48,745	
McLennan	26,218	26,236	26,262	26,297	26,319	26,341	26,362	26,383	26,403	26,423	26,442	
Montgomery	49,839	49,936	50,084	50,184	50,262	50,339	50,416	50,489	50,562	50,632	50,701	
Tarrant	251,316	251,896	252,138	252,461	252,638	252,804	252,974	253,143	253,319	253,484	253,654	
Travis	79,645	79,787	79,922	80,031	80,139	80,246	80,353	80,461	80,567	80,676	80,782	
Williamson	43,384	43,474	43,590	43,748	43,816	43,884	43,952	44,021	44,090	44,159	44,228	

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:											
	4/5	4/6	4/7	4/8	4/10				4/12				4/14			
Bexar	207,949	208,172	208,462	208,606	209,368	(41,874)	[10,050]	{5,025}	210,152	(42,030)	[10,087]	{5,044}	210,961	(42,192)	[10,126]	{5,063}
Brazoria	35,743	35,749	35,918	35,970	36,070	(7,214)	[1,731]	{866}	36,164	(7,233)	[1,736]	{868}	36,262	(7,252)	[1,741]	{870}
Brazos	25,265	25,276	25,326	25,408	25,460	(5,092)	[1,222]	{611}	25,510	(5,102)	[1,224]	{612}	25,554	(5,111)	[1,227]	{613}
Collin	87,092	87,267	87,275	87,422	87,618	(17,524)	[4,206]	{2,103}	87,822	(17,564)	[4,215]	{2,108}	88,022	(17,604)	[4,225]	{2,113}
Dallas	292,364	292,743	293,121	293,150	293,573	(58,715)	[14,092]	{7,046}	293,970	(58,794)	[14,111]	{7,055}	294,346	(58,869)	[14,129]	{7,064}
Denton	72,160	72,321	72,422	72,498	72,618	(14,524)	[3,486]	{1,743}	72,731	(14,546)	[3,491]	{1,746}	72,839	(14,568)	[3,496]	{1,748}
El Paso	130,250	130,457	130,647	130,875	131,202	(26,240)	[6,298]	{3,149}	131,536	(26,307)	[6,314]	{3,157}	131,869	(26,374)	[6,330]	{3,165}
Ellis	22,177	22,183	22,203	22,223	22,255	(4,451)	[1,068]	{534}	22,288	(4,458)	[1,070]	{535}	22,319	(4,464)	[1,071]	{536}
Fort Bend	63,656	64,010	64,113	64,271	64,451	(12,890)	[3,094]	{1,547}	64,626	(12,925)	[3,102]	{1,551}	64,791	(12,958)	[3,110]	{1,555}
Galveston	37,397	37,436	37,525	37,590	37,699	(7,540)	[1,810]	{905}	37,806	(7,561)	[1,815]	{907}	37,909	(7,582)	[1,820]	{910}
Harris	379,684	380,297	380,652	381,221	382,232	(76,446)	[18,347]	{9,174}	383,161	(76,632)	[18,392]	{9,196}	384,031	(76,806)	[18,434]	{9,217}
Hidalgo	85,206	85,296	85,628	85,899	86,056	(17,211)	[4,131]	{2,065}	86,208	(17,242)	[4,138]	{2,069}	86,341	(17,268)	[4,144]	{2,072}
Johnson	19,375	19,382	19,396	19,411	19,435	(3,887)	[933]	{466}	19,457	(3,891)	[934]	{467}	19,478	(3,896)	[935]	{467}
Lubbock	48,635	48,647	48,661	48,671	48,692	(9,738)	[2,337]	{1,169}	48,713	(9,743)	[2,338]	{1,169}	48,735	(9,747)	[2,339]	{1,170}
McLennan	26,218	26,236	26,262	26,297	26,341	(5,268)	[1,264]	{632}	26,383	(5,277)	[1,266]	{633}	26,423	(5,285)	[1,268]	{634}
Montgomery	49,839	49,936	50,084	50,184	50,339	(10,068)	[2,416]	{1,208}	50,489	(10,098)	[2,423]	{1,212}	50,632	(10,126)	[2,430]	{1,215}
Tarrant	251,316	251,896	252,138	252,461	252,804	(50,561)	[12,135]	{6,067}	253,143	(50,629)	[12,151]	{6,075}	253,484	(50,697)	[12,167]	{6,084}
Travis	79,645	79,787	79,922	80,031	80,246	(16,049)	[3,852]	{1,926}	80,461	(16,092)	[3,862]	{1,931}	80,676	(16,135)	[3,872]	{1,936}
Williamson	43,384	43,474	43,590	43,748	43,884	(8,777)	[2,106]	{1,053}	44,021	(8,804)	[2,113]	{1,057}	44,159	(8,832)	[2,120]	{1,060}

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.