

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 7/17/20**

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 20%, and are often within 10%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 7/17/20 11 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.

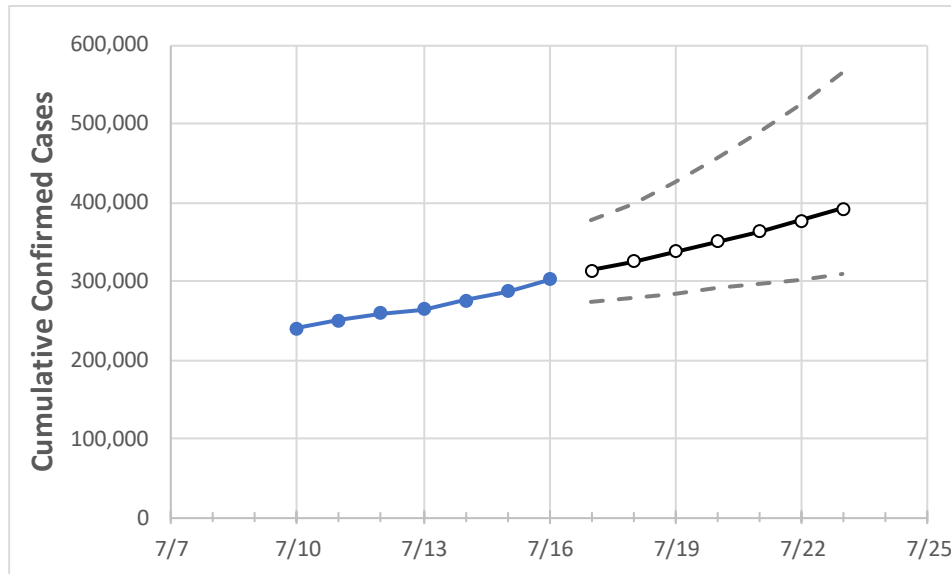
IEM's Modeling Lead

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:						
	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20	7/21	7/22	7/23
Texas	264,295	275,039	286,420	301,791	313,115	324,899	337,163	349,927	363,212	377,043	391,442

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 20%, and are often within 10%, of actual confirmed cases.

Texas Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20	7/21	7/22	7/23
Bexar	19,648	20,213	21,546	27,047	28,245	29,521	30,880	32,328	33,871	35,518	37,274
Brazoria	3,550	3,834	3,988	4,190	4,350	4,519	4,695	4,879	5,072	5,275	5,487
Brazos	3,006	3,066	3,120	3,200	3,272	3,343	3,413	3,484	3,554	3,623	3,692
Collin	4,533	4,685	4,800	4,934	5,090	5,252	5,419	5,592	5,771	5,957	6,149
Dallas	33,800	34,914	35,914	36,969	38,226	39,531	40,885	42,290	43,746	45,257	46,822
Denton	4,049	4,162	4,316	4,467	4,598	4,734	4,873	5,017	5,166	5,320	5,478
El Paso	9,716	9,953	10,298	10,638	10,983	11,337	11,701	12,076	12,461	12,858	13,266
Ellis	1,656	1,729	1,811	1,837	1,903	1,970	2,041	2,113	2,188	2,265	2,345
Fort Bend	4,799	5,015	5,211	5,284	5,392	5,505	5,623	5,745	5,873	6,005	6,144
Galveston	6,037	6,201	6,307	6,452	6,628	6,803	6,977	7,151	7,323	7,495	7,666
Harris	45,368	47,369	49,027	50,370	51,917	53,521	55,184	56,909	58,698	60,552	62,473
Hidalgo	8,040	8,119	8,197	8,593	8,811	9,031	9,251	9,471	9,691	9,911	10,131
Johnson	853	885	918	918	946	973	1,001	1,028	1,056	1,083	1,111
Lubbock	3,748	3,823	3,943	4,063	4,181	4,300	4,422	4,545	4,671	4,798	4,928
McLennan	2,557	2,744	2,920	3,005	3,088	3,171	3,254	3,336	3,417	3,498	3,579
Montgomery	3,077	3,112	3,471	4,324	4,462	4,610	4,767	4,935	5,114	5,304	5,507
Tarrant	18,161	18,483	19,014	19,871	20,431	21,012	21,615	22,239	22,887	23,558	24,253
Travis	14,788	15,445	15,998	16,570	17,000	17,434	17,872	18,315	18,763	19,216	19,673
Williamson	3,810	4,042	4,153	4,327	4,473	4,623	4,778	4,937	5,100	5,267	5,439

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:											
	7/13	7/14	7/15	7/16	7/18				7/20				7/22			
Bexar	19,648	20,213	21,546	27,047	29,521	(5,904)	[1,417]	{709}	32,328	(6,466)	[1,552]	{776}	35,518	(7,104)	[1,705]	{852}
Brazoria	3,550	3,834	3,988	4,190	4,519	(904)	[217]	{108}	4,879	(976)	[234]	{117}	5,275	(1,055)	[253]	{127}
Brazos	3,006	3,066	3,120	3,200	3,343	(669)	[160]	{80}	3,484	(697)	[167]	{84}	3,623	(725)	[174]	{87}
Collin	4,533	4,685	4,800	4,934	5,252	(1,050)	[252]	{126}	5,592	(1,118)	[268]	{134}	5,957	(1,191)	[286]	{143}
Dallas	33,800	34,914	35,914	36,969	39,531	(7,906)	[1,897]	{949}	42,290	(8,458)	[2,030]	{1,015}	45,257	(9,051)	[2,172]	{1,086}
Denton	4,049	4,162	4,316	4,467	4,734	(947)	[227]	{114}	5,017	(1,003)	[241]	{120}	5,320	(1,064)	[255]	{128}
El Paso	9,716	9,953	10,298	10,638	11,337	(2,267)	[544]	{272}	12,076	(2,415)	[580]	{290}	12,858	(2,572)	[617]	{309}
Ellis	1,656	1,729	1,811	1,837	1,970	(394)	[95]	{47}	2,113	(423)	[101]	{51}	2,265	(453)	[109]	{54}
Fort Bend	4,799	5,015	5,211	5,284	5,505	(1,101)	[264]	{132}	5,745	(1,149)	[276]	{138}	6,005	(1,201)	[288]	{144}
Galveston	6,037	6,201	6,307	6,452	6,803	(1,361)	[327]	{163}	7,151	(1,430)	[343]	{172}	7,495	(1,499)	[360]	{180}
Harris	45,368	47,369	49,027	50,370	53,521	(10,704)	[2,569]	{1,284}	56,909	(11,382)	[2,732]	{1,366}	60,552	(12,110)	[2,906]	{1,453}
Hidalgo	8,040	8,119	8,197	8,593	9,031	(1,806)	[433]	{217}	9,471	(1,894)	[455]	{227}	9,911	(1,982)	[476]	{238}
Johnson	853	885	918	918	973	(195)	[47]	{23}	1,028	(206)	[49]	{25}	1,083	(217)	[52]	{26}
Lubbock	3,748	3,823	3,943	4,063	4,300	(860)	[206]	{103}	4,545	(909)	[218]	{109}	4,798	(960)	[230]	{115}
McLennan	2,557	2,744	2,920	3,005	3,171	(634)	[152]	{76}	3,336	(667)	[160]	{80}	3,498	(700)	[168]	{84}
Montgomery	3,077	3,112	3,471	4,324	4,610	(922)	[221]	{111}	4,935	(987)	[237]	{118}	5,304	(1,061)	[255]	{127}
Tarrant	18,161	18,483	19,014	19,871	21,012	(4,202)	[1,009]	{504}	22,239	(4,448)	[1,067]	{534}	23,558	(4,712)	[1,131]	{565}
Travis	14,788	15,445	15,998	16,570	17,434	(3,487)	[837]	{418}	18,315	(3,663)	[879]	{440}	19,216	(3,843)	[922]	{461}
Williamson	3,810	4,042	4,153	4,327	4,623	(925)	[222]	{111}	4,937	(987)	[237]	{118}	5,267	(1,053)	[253]	{126}

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.