

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

Date: 9/9/20

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 9/9/20 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.

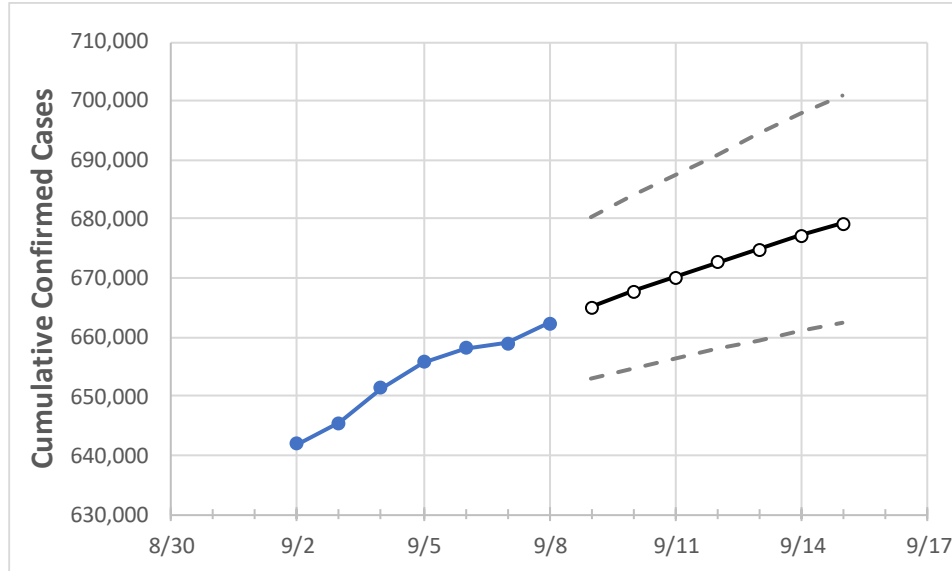
IEM's Modeling Lead

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:						
	9/5	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14	9/15
Texas	655,815	658,202	659,041	662,427	665,111	667,698	670,191	672,594	674,909	677,140	679,290

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:						
	9/5	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14	9/15
Bexar	47,315	47,543	47,640	47,736	47,864	47,990	48,115	48,238	48,360	48,481	48,600
Brazoria	9,642	9,817	9,882	9,924	9,980	10,036	10,090	10,144	10,197	10,248	10,299
Brazos	5,201	5,271	5,359	5,442	5,546	5,658	5,778	5,906	6,043	6,190	6,347
Collin	11,424	11,481	11,534	11,632	11,688	11,745	11,802	11,860	11,917	11,975	12,034
Dallas	73,453	73,700	73,900	74,100	74,300	74,492	74,676	74,853	75,023	75,186	75,343
Denton	10,588	10,614	10,639	10,766	10,841	10,916	10,989	11,061	11,132	11,202	11,271
El Paso	20,850	20,939	21,093	21,187	21,269	21,349	21,427	21,502	21,575	21,645	21,714
Ellis	3,888	3,888	3,888	3,888	3,907	3,926	3,945	3,963	3,981	3,999	4,017
Fort Bend	15,144	15,149	15,153	15,158	15,182	15,204	15,225	15,245	15,265	15,283	15,300
Galveston	10,808	10,874	10,941	11,007	11,040	11,072	11,105	11,137	11,168	11,199	11,230
Harris	110,762	111,525	111,782	112,039	112,653	113,253	113,839	114,412	114,972	115,519	116,053
Hidalgo	28,480	28,591	28,732	28,893	29,021	29,144	29,264	29,379	29,490	29,598	29,701
Johnson	2,587	2,587	2,587	2,587	2,596	2,605	2,613	2,621	2,629	2,637	2,644
Lubbock	8,606	8,867	8,912	8,983	9,144	9,314	9,494	9,684	9,885	10,098	10,323
McLennan	6,668	6,707	6,726	6,766	6,822	6,877	6,932	6,987	7,042	7,096	7,150
Montgomery	9,217	9,271	9,324	9,377	9,440	9,504	9,566	9,629	9,691	9,753	9,814
Tarrant	42,798	42,884	42,969	43,055	43,190	43,319	43,443	43,562	43,676	43,785	43,890
Travis	26,931	26,969	27,038	27,124	27,172	27,218	27,261	27,303	27,342	27,380	27,416
Williamson	8,041	8,058	8,075	8,092	8,106	8,119	8,131	8,142	8,153	8,164	8,174

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:											
	9/5	9/6	9/7	9/8	9/10				9/12				9/14			
Bexar	47,315	47,543	47,640	47,736	47,990	(9,598)	[2,304]	{1,152}	48,238	(9,648)	[2,315]	{1,158}	48,481	(9,696)	[2,327]	{1,164}
Brazoria	9,642	9,817	9,882	9,924	10,036	(2,007)	[482]	{241}	10,144	(2,029)	[487]	{243}	10,248	(2,050)	[492]	{246}
Brazos	5,201	5,271	5,359	5,442	5,658	(1,132)	[272]	{136}	5,906	(1,181)	[283]	{142}	6,190	(1,238)	[297]	{149}
Collin	11,424	11,481	11,534	11,632	11,745	(2,349)	[564]	{282}	11,860	(2,372)	[569]	{285}	11,975	(2,395)	[575]	{287}
Dallas	73,453	73,700	73,900	74,100	74,492	(14,898)	[3,576]	{1,788}	74,853	(14,971)	[3,593]	{1,796}	75,186	(15,037)	[3,609]	{1,804}
Denton	10,588	10,614	10,639	10,766	10,916	(2,183)	[524]	{262}	11,061	(2,212)	[531]	{265}	11,202	(2,240)	[538]	{269}
El Paso	20,850	20,939	21,093	21,187	21,349	(4,270)	[1,025]	{512}	21,502	(4,300)	[1,032]	{516}	21,645	(4,329)	[1,039]	{519}
Ellis	3,888	3,888	3,888	3,888	3,926	(785)	[188]	{94}	3,963	(793)	[190]	{95}	3,999	(800)	[192]	{96}
Fort Bend	15,144	15,149	15,153	15,158	15,204	(3,041)	[730]	{365}	15,245	(3,049)	[732]	{366}	15,283	(3,057)	[734]	{367}
Galveston	10,808	10,874	10,941	11,007	11,072	(2,214)	[531]	{266}	11,137	(2,227)	[535]	{267}	11,199	(2,240)	[538]	{269}
Harris	110,762	111,525	111,782	112,039	113,253	(22,651)	[5,436]	{2,718}	114,412	(22,882)	[5,492]	{2,746}	115,519	(23,104)	[5,545]	{2,772}
Hidalgo	28,480	28,591	28,732	28,893	29,144	(5,829)	[1,399]	{699}	29,379	(5,876)	[1,410]	{705}	29,598	(5,920)	[1,421]	{710}
Johnson	2,587	2,587	2,587	2,587	2,605	(521)	[125]	{63}	2,621	(524)	[126]	{63}	2,637	(527)	[127]	{63}
Lubbock	8,606	8,867	8,912	8,983	9,314	(1,863)	[447]	{224}	9,684	(1,937)	[465]	{232}	10,098	(2,020)	[485]	{242}
McLennan	6,668	6,707	6,726	6,766	6,877	(1,375)	[330]	{165}	6,987	(1,397)	[335]	{168}	7,096	(1,419)	[341]	{170}
Montgomery	9,217	9,271	9,324	9,377	9,504	(1,901)	[456]	{228}	9,629	(1,926)	[462]	{231}	9,753	(1,951)	[468]	{234}
Tarrant	42,798	42,884	42,969	43,055	43,319	(8,664)	[2,079]	{1,040}	43,562	(8,712)	[2,091]	{1,045}	43,785	(8,757)	[2,102]	{1,051}
Travis	26,931	26,969	27,038	27,124	27,218	(5,444)	[1,306]	{653}	27,303	(5,461)	[1,311]	{655}	27,380	(5,476)	[1,314]	{657}
Williamson	8,041	8,058	8,075	8,092	8,119	(1,624)	[390]	{195}	8,142	(1,628)	[391]	{195}	8,164	(1,633)	[392]	{196}

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.