

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

Date: 3/4/21

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 3/4/21 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.

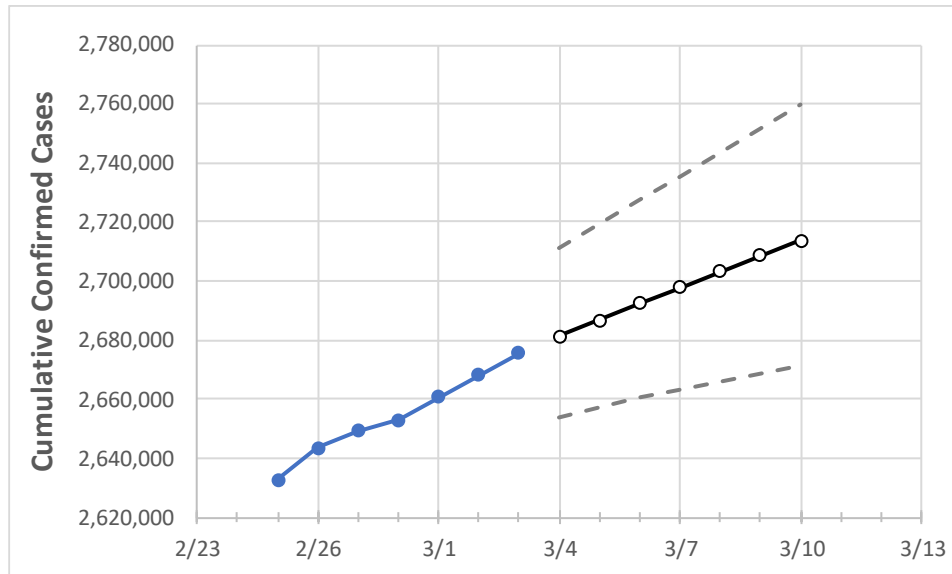
IEM's Modeling Lead

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:						
	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10
Texas	2,653,013	2,660,791	2,668,091	2,675,712	2,681,363	2,686,893	2,692,428	2,697,869	2,703,338	2,708,574	2,713,596

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:						
	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10
Bexar	196,528	196,816	197,065	197,255	197,690	198,108	198,513	198,920	199,314	199,699	200,096
Brazoria	32,834	32,966	33,040	33,152	33,264	33,390	33,512	33,627	33,751	33,866	34,000
Brazos	21,005	21,046	21,172	21,243	21,304	21,366	21,428	21,491	21,551	21,612	21,676
Collin	83,289	83,404	83,404	83,404	83,564	83,723	83,873	84,017	84,164	84,294	84,431
Dallas	280,780	281,155	281,681	282,399	282,736	283,068	283,392	283,692	283,983	284,279	284,564
Denton	64,346	64,697	65,171	65,821	66,264	66,726	67,194	67,676	68,161	68,675	69,185
El Paso	123,690	123,979	124,162	124,438	124,678	124,900	125,129	125,344	125,558	125,774	125,972
Ellis	20,754	20,793	20,833	20,936	20,967	20,997	21,027	21,057	21,085	21,110	21,135
Fort Bend	57,671	57,721	58,219	58,663	58,854	59,048	59,236	59,423	59,607	59,800	59,980
Galveston	34,591	34,664	34,736	34,896	34,992	35,086	35,178	35,270	35,359	35,446	35,532
Harris	350,201	351,063	353,450	355,065	356,195	357,355	358,477	359,626	360,816	362,019	363,228
Hidalgo	77,103	77,312	77,702	78,165	78,622	79,073	79,521	79,980	80,416	80,881	81,344
Johnson	18,548	18,578	18,608	18,655	18,680	18,707	18,731	18,756	18,780	18,803	18,824
Lubbock	48,147	48,160	48,175	48,191	48,207	48,222	48,235	48,248	48,261	48,273	48,283
McLennan	25,060	25,096	25,132	25,192	25,247	25,300	25,354	25,406	25,458	25,512	25,563
Montgomery	45,352	45,528	45,635	45,872	46,005	46,136	46,266	46,396	46,523	46,650	46,774
Tarrant	242,144	242,638	243,067	243,725	244,163	244,598	245,025	245,451	245,860	246,275	246,695
Travis	75,636	75,901	76,088	76,274	76,396	76,521	76,645	76,771	76,887	77,000	77,118
Williamson	40,848	40,927	41,137	41,194	41,286	41,378	41,472	41,565	41,659	41,751	41,845

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:											
	2/28	3/1	3/2	3/3	3/5			3/7			3/9					
Bexar	196,528	196,816	197,065	197,255	198,108	(39,622)	[9,509]	{4,755}	198,920	(39,784)	[9,548]	{4,774}	199,699	(39,940)	[9,586]	{4,793}
Brazoria	32,834	32,966	33,040	33,152	33,390	(6,678)	[1,603]	{801}	33,627	(6,725)	[1,614]	{807}	33,866	(6,773)	[1,626]	{813}
Brazos	21,005	21,046	21,172	21,243	21,366	(4,273)	[1,026]	{513}	21,491	(4,298)	[1,032]	{516}	21,612	(4,322)	[1,037]	{519}
Collin	83,289	83,404	83,404	83,404	83,723	(16,745)	[4,019]	{2,009}	84,017	(16,803)	[4,033]	{2,016}	84,294	(16,859)	[4,046]	{2,023}
Dallas	280,780	281,155	281,681	282,399	283,068	(56,614)	[13,587]	{6,794}	283,692	(56,738)	[13,617]	{6,809}	284,279	(56,856)	[13,645]	{6,823}
Denton	64,346	64,697	65,171	65,821	66,726	(13,345)	[3,203]	{1,601}	67,676	(13,535)	[3,248]	{1,624}	68,675	(13,735)	[3,296]	{1,648}
El Paso	123,690	123,979	124,162	124,438	124,900	(24,980)	[5,995]	{2,998}	125,344	(25,069)	[6,017]	{3,008}	125,774	(25,155)	[6,037]	{3,019}
Ellis	20,754	20,793	20,833	20,936	20,997	(4,199)	[1,008]	{504}	21,057	(4,211)	[1,011]	{505}	21,110	(4,222)	[1,013]	{507}
Fort Bend	57,671	57,721	58,219	58,663	59,048	(11,810)	[2,834]	{1,417}	59,423	(11,885)	[2,852]	{1,426}	59,800	(11,960)	[2,870]	{1,435}
Galveston	34,591	34,664	34,736	34,896	35,086	(7,017)	[1,684]	{842}	35,270	(7,054)	[1,693]	{846}	35,446	(7,089)	[1,701]	{851}
Harris	350,201	351,063	353,450	355,065	357,355	(71,471)	[17,153]	{8,577}	359,626	(71,925)	[17,262]	{8,631}	362,019	(72,404)	[17,377]	{8,688}
Hidalgo	77,103	77,312	77,702	78,165	79,073	(15,815)	[3,796]	{1,898}	79,980	(15,996)	[3,839]	{1,920}	80,881	(16,176)	[3,882]	{1,941}
Johnson	18,548	18,578	18,608	18,655	18,707	(3,741)	[898]	{449}	18,756	(3,751)	[900]	{450}	18,803	(3,761)	[903]	{451}
Lubbock	48,147	48,160	48,175	48,191	48,222	(9,644)	[2,315]	{1,157}	48,248	(9,650)	[2,316]	{1,158}	48,273	(9,655)	[2,317]	{1,159}
McLennan	25,060	25,096	25,132	25,192	25,300	(5,060)	[1,214]	{607}	25,406	(5,081)	[1,219]	{610}	25,512	(5,102)	[1,225]	{612}
Montgomery	45,352	45,528	45,635	45,872	46,136	(9,227)	[2,215]	{1,107}	46,396	(9,279)	[2,227]	{1,113}	46,650	(9,330)	[2,239]	{1,120}
Tarrant	242,144	242,638	243,067	243,725	244,598	(48,920)	[11,741]	{5,870}	245,451	(49,090)	[11,782]	{5,891}	246,275	(49,255)	[11,821]	{5,911}
Travis	75,636	75,901	76,088	76,274	76,521	(15,304)	[3,673]	{1,837}	76,771	(15,354)	[3,685]	{1,843}	77,000	(15,400)	[3,696]	{1,848}
Williamson	40,848	40,927	41,137	41,194	41,378	(8,276)	[1,986]	{993}	41,565	(8,313)	[1,995]	{998}	41,751	(8,350)	[2,004]	{1,002}

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.