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

Date: 1/14/22

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 1/14/22 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.

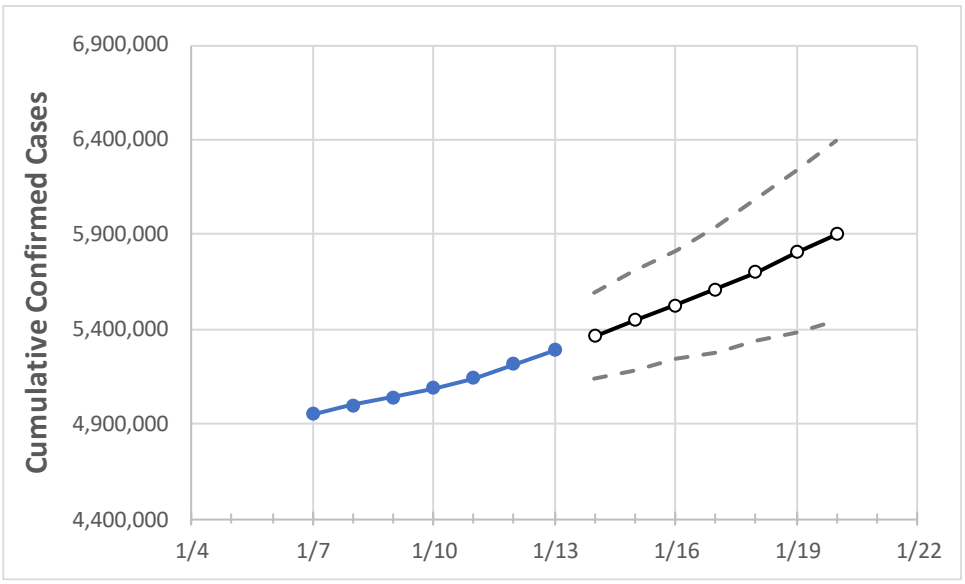
IEM's Modeling Lead

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:						
	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19	1/20
Texas	5,087,686	5,143,345	5,217,482	5,289,510	5,364,642	5,445,836	5,526,488	5,612,798	5,702,460	5,807,620	5,903,666

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:						
	1/10	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19	1/20
Bexar	382,071	387,048	395,881	402,341	409,629	417,353	425,706	434,553	443,917	454,068	464,715
Brazoria	75,794	76,502	77,408	78,402	79,347	80,289	81,234	82,212	83,223	84,250	85,287
Brazos	46,882	47,444	47,748	48,387	49,133	49,887	50,692	51,532	52,404	53,318	54,242
Collin	158,356	160,585	163,213	165,846	168,413	171,122	173,992	176,962	180,112	183,487	186,962
Dallas	481,528	486,776	493,676	500,937	507,637	514,623	522,121	529,797	538,038	546,766	555,846
Denton	131,984	133,641	136,117	138,621	140,991	143,436	146,048	148,845	151,804	154,882	158,195
El Paso	176,626	177,815	180,008	182,096	184,091	186,250	188,561	191,103	193,825	196,820	199,939
Ellis	39,098	39,509	40,047	40,493	40,993	41,523	42,086	42,671	43,289	43,947	44,629
Fort Bend	136,399	138,960	141,767	143,527	146,039	148,553	151,172	153,831	156,648	159,541	162,489
Galveston	80,124	80,969	81,938	82,931	84,043	85,181	86,355	87,562	88,784	90,059	91,360
Harris	752,947	763,214	775,079	784,256	796,043	809,390	821,609	835,982	849,925	863,612	879,097
Hidalgo	132,460	133,585	135,002	136,311	138,028	139,895	141,908	144,077	146,412	149,009	151,754
Johnson	33,174	33,570	34,158	34,571	35,024	35,496	36,001	36,537	37,110	37,728	38,363
Lubbock	78,409	79,518	80,535	81,551	82,638	83,774	84,992	86,249	87,627	89,047	90,541
McLennan	48,062	48,506	49,301	49,847	50,471	51,146	51,862	52,634	53,449	54,334	55,265
Montgomery	108,956	110,225	111,998	113,326	115,004	116,684	118,437	120,284	122,200	124,248	126,283
Tarrant	423,880	428,473	435,237	442,103	448,339	455,100	462,104	469,763	477,839	486,473	495,530
Travis	159,483	161,650	164,007	167,703	170,877	174,153	177,539	181,134	184,804	188,676	192,713
Williamson	97,543	98,406	99,822	101,813	103,547	105,420	107,286	109,301	111,396	113,584	115,949

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:											
	1/10	1/11	1/12	1/13	1/15				1/17				1/19			
Bexar	382,071	387,048	395,881	402,341	417,353	(83,471)	[20,033]	{10,016}	434,553	(86,911)	[20,859]	{10,429}	454,068	(90,814)	[21,795]	{10,898}
Brazoria	75,794	76,502	77,408	78,402	80,289	(16,058)	[3,854]	{1,927}	82,212	(16,442)	[3,946]	{1,973}	84,250	(16,850)	[4,044]	{2,022}
Brazos	46,882	47,444	47,748	48,387	49,887	(9,977)	[2,395]	{1,197}	51,532	(10,306)	[2,474]	{1,237}	53,318	(10,664)	[2,559]	{1,280}
Collin	158,356	160,585	163,213	165,846	171,122	(34,224)	[8,214]	{4,107}	176,962	(35,392)	[8,494]	{4,247}	183,487	(36,697)	[8,807]	{4,404}
Dallas	481,528	486,776	493,676	500,937	514,623	(102,925)	[24,702]	{12,351}	529,797	(105,959)	[25,430]	{12,715}	546,766	(109,353)	[26,245]	{13,122}
Denton	131,984	133,641	136,117	138,621	143,436	(28,687)	[6,885]	{3,442}	148,845	(29,769)	[7,145]	{3,572}	154,882	(30,976)	[7,434]	{3,717}
El Paso	176,626	177,815	180,008	182,096	186,250	(37,250)	[8,940]	{4,470}	191,103	(38,221)	[9,173]	{4,586}	196,820	(39,364)	[9,447]	{4,724}
Ellis	39,098	39,509	40,047	40,493	41,523	(8,305)	[1,993]	{997}	42,671	(8,534)	[2,048]	{1,024}	43,947	(8,789)	[2,109]	{1,055}
Fort Bend	136,399	138,960	141,767	143,527	148,553	(29,711)	[7,131]	{3,565}	153,831	(30,766)	[7,384]	{3,692}	159,541	(31,908)	[7,658]	{3,829}
Galveston	80,124	80,969	81,938	82,931	85,181	(17,036)	[4,089]	{2,044}	87,562	(17,512)	[4,203]	{2,101}	90,059	(18,012)	[4,323]	{2,161}
Harris	752,947	763,214	775,079	784,256	809,390	(161,878)	[38,851]	{19,425}	835,982	(167,196)	[40,127]	{20,064}	863,612	(172,722)	[41,453]	{20,727}
Hidalgo	132,460	133,585	135,002	136,311	139,895	(27,979)	[6,715]	{3,357}	144,077	(28,815)	[6,916]	{3,458}	149,009	(29,802)	[7,152]	{3,576}
Johnson	33,174	33,570	34,158	34,571	35,496	(7,099)	[1,704]	{852}	36,537	(7,307)	[1,754]	{877}	37,728	(7,546)	[1,811]	{905}
Lubbock	78,409	79,518	80,535	81,551	83,774	(16,755)	[4,021]	{2,011}	86,249	(17,250)	[4,140]	{2,070}	89,047	(17,809)	[4,274]	{2,137}
McLennan	48,062	48,506	49,301	49,847	51,146	(10,229)	[2,455]	{1,228}	52,634	(10,527)	[2,526]	{1,263}	54,334	(10,867)	[2,608]	{1,304}
Montgomery	108,956	110,225	111,998	113,326	116,684	(23,337)	[5,601]	{2,800}	120,284	(24,057)	[5,774]	{2,887}	124,248	(24,850)	[5,964]	{2,982}
Tarrant	423,880	428,473	435,237	442,103	455,100	(91,020)	[21,845]	{10,922}	469,763	(93,953)	[22,549]	{11,274}	486,473	(97,295)	[23,351]	{11,675}
Travis	159,483	161,650	164,007	167,703	174,153	(34,831)	[8,359]	{4,180}	181,134	(36,227)	[8,694]	{4,347}	188,676	(37,735)	[9,056]	{4,528}
Williamson	97,543	98,406	99,822	101,813	105,420	(21,084)	[5,060]	{2,530}	109,301	(21,860)	[5,246]	{2,623}	113,584	(22,717)	[5,452]	{2,726}

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.