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

Date: 1/10/22

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 1/10/22 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.

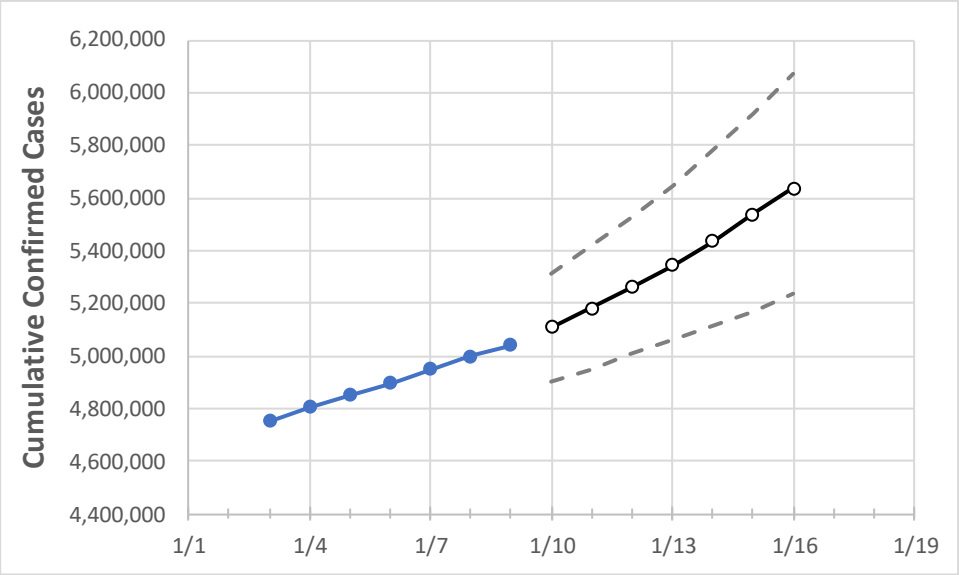
IEM's Modeling Lead

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:						
	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16
Texas	4,897,362	4,949,933	4,999,623	5,039,605	5,109,145	5,182,472	5,262,104	5,344,946	5,435,493	5,537,010	5,638,620

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:						
	1/6	1/7	1/8	1/9	1/10	1/11	1/12	1/13	1/14	1/15	1/16
Bexar	364,040	368,885	373,781	377,644	383,492	389,648	396,451	403,816	412,017	420,918	430,486
Brazoria	73,137	74,024	74,632	75,208	76,453	77,765	79,160	80,615	82,156	83,811	85,550
Brazos	44,709	45,559	46,041	46,425	47,483	48,653	49,966	51,426	53,052	54,888	56,878
Collin	152,472	153,689	155,567	156,890	159,084	161,378	163,870	166,544	169,407	172,571	175,850
Dallas	465,748	468,826	473,735	477,343	482,961	488,827	495,321	502,086	509,547	517,322	525,801
Denton	126,785	127,874	129,486	130,639	132,650	134,824	137,110	139,626	142,393	145,344	148,548
El Paso	172,015	172,829	174,338	174,930	175,887	176,896	177,993	179,141	180,359	181,693	183,048
Ellis	37,817	38,092	38,472	38,727	39,164	39,637	40,133	40,673	41,253	41,874	42,535
Fort Bend	130,060	132,019	133,869	134,962	137,986	141,202	144,503	148,178	152,034	156,242	160,658
Galveston	76,694	77,655	78,481	79,208	80,694	82,287	83,992	85,842	87,857	89,980	92,296
Harris	718,772	729,875	738,421	745,996	760,716	776,081	791,284	808,399	827,116	846,965	867,075
Hidalgo	126,710	128,459	129,882	131,389	132,634	133,994	135,465	137,060	138,765	140,638	142,629
Johnson	32,269	32,434	32,746	32,933	33,236	33,557	33,897	34,262	34,653	35,065	35,498
Lubbock	75,475	76,191	77,074	77,777	78,652	79,612	80,639	81,720	82,899	84,171	85,528
McLennan	46,465	46,919	47,270	47,692	48,150	48,641	49,170	49,744	50,374	51,054	51,796
Montgomery	104,090	105,568	106,717	107,924	109,687	111,571	113,574	115,707	118,029	120,534	123,180
Tarrant	409,340	412,824	417,222	420,274	425,205	430,490	436,261	442,400	449,283	456,573	464,368
Travis	150,505	153,005	155,446	157,418	160,911	164,794	168,873	173,441	178,251	183,506	189,227
Williamson	92,425	93,937	94,780	95,716	97,479	99,331	101,306	103,518	105,832	108,393	111,123

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:											
	1/6	1/7	1/8	1/9	1/11				1/13				1/15			
Bexar	364,040	368,885	373,781	377,644	389,648	(77,930)	[18,703]	{9,352}	403,816	(80,763)	[19,383]	{9,692}	420,918	(84,184)	[20,204]	{10,102}
Brazoria	73,137	74,024	74,632	75,208	77,765	(15,553)	[3,733]	{1,866}	80,615	(16,123)	[3,869]	{1,935}	83,811	(16,762)	[4,023]	{2,011}
Brazos	44,709	45,559	46,041	46,425	48,653	(9,731)	[2,335]	{1,168}	51,426	(10,285)	[2,468]	{1,234}	54,888	(10,978)	[2,635]	{1,317}
Collin	152,472	153,689	155,567	156,890	161,378	(32,276)	[7,746]	{3,873}	166,544	(33,309)	[7,994]	{3,997}	172,571	(34,514)	[8,283]	{4,142}
Dallas	465,748	468,826	473,735	477,343	488,827	(97,765)	[23,464]	{11,732}	502,086	(100,417)	[24,100]	{12,050}	517,322	(103,464)	[24,831]	{12,416}
Denton	126,785	127,874	129,486	130,639	134,824	(26,965)	[6,472]	{3,236}	139,626	(27,925)	[6,702]	{3,351}	145,344	(29,069)	[6,976]	{3,488}
El Paso	172,015	172,829	174,338	174,930	176,896	(35,379)	[8,491]	{4,246}	179,141	(35,828)	[8,599]	{4,299}	181,693	(36,339)	[8,721]	{4,361}
Ellis	37,817	38,092	38,472	38,727	39,637	(7,927)	[1,903]	{951}	40,673	(8,135)	[1,952]	{976}	41,874	(8,375)	[2,010]	{1,005}
Fort Bend	130,060	132,019	133,869	134,962	141,202	(28,240)	[6,778]	{3,389}	148,178	(29,636)	[7,113]	{3,556}	156,242	(31,248)	[7,500]	{3,750}
Galveston	76,694	77,655	78,481	79,208	82,287	(16,457)	[3,950]	{1,975}	85,842	(17,168)	[4,120]	{2,060}	89,980	(17,996)	[4,319]	{2,160}
Harris	718,772	729,875	738,421	745,996	776,081	(155,216)	[37,252]	{18,626}	808,399	(161,680)	[38,803]	{19,402}	846,965	(169,393)	[40,654]	{20,327}
Hidalgo	126,710	128,459	129,882	131,389	133,994	(26,799)	[6,432]	{3,216}	137,060	(27,412)	[6,579]	{3,289}	140,638	(28,128)	[6,751]	{3,375}
Johnson	32,269	32,434	32,746	32,933	33,557	(6,711)	[1,611]	{805}	34,262	(6,852)	[1,645]	{822}	35,065	(7,013)	[1,683]	{842}
Lubbock	75,475	76,191	77,074	77,777	79,612	(15,922)	[3,821]	{1,911}	81,720	(16,344)	[3,923]	{1,961}	84,171	(16,834)	[4,040]	{2,020}
McLennan	46,465	46,919	47,270	47,692	48,641	(9,728)	[2,335]	{1,167}	49,744	(9,949)	[2,388]	{1,194}	51,054	(10,211)	[2,451]	{1,225}
Montgomery	104,090	105,568	106,717	107,924	111,571	(22,314)	[5,355]	{2,678}	115,707	(23,141)	[5,554]	{2,777}	120,534	(24,107)	[5,786]	{2,893}
Tarrant	409,340	412,824	417,222	420,274	430,490	(86,098)	[20,664]	{10,332}	442,400	(88,480)	[21,235]	{10,618}	456,573	(91,315)	[21,915]	{10,958}
Travis	150,505	153,005	155,446	157,418	164,794	(32,959)	[7,910]	{3,955}	173,441	(34,688)	[8,325]	{4,163}	183,506	(36,701)	[8,808]	{4,404}
Williamson	92,425	93,937	94,780	95,716	99,331	(19,866)	[4,768]	{2,384}	103,518	(20,704)	[4,969]	{2,484}	108,393	(21,679)	[5,203]	{2,601}

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.