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

Date: 8/20/21

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 8/20/21 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.

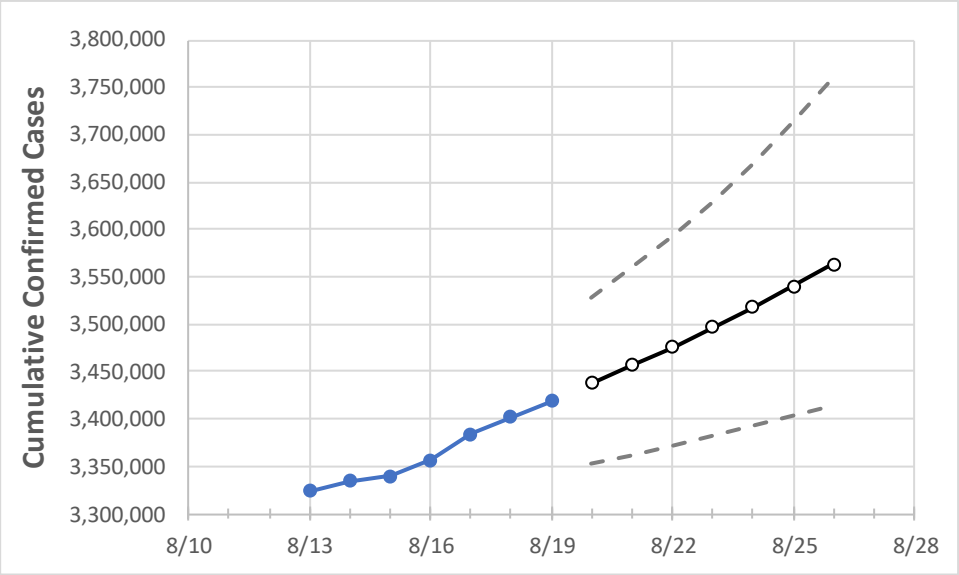
IEM's Modeling Lead

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:						
	8/16	8/17	8/18	8/19	8/20	8/21	8/22	8/23	8/24	8/25	8/26
Texas	3,356,260	3,384,466	3,402,025	3,419,098	3,437,312	3,456,325	3,476,065	3,496,873	3,517,650	3,540,454	3,563,196

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:						
	8/16	8/17	8/18	8/19	8/20	8/21	8/22	8/23	8/24	8/25	8/26
Bexar	264,238	266,027	267,630	268,970	270,754	272,552	274,418	276,304	278,271	280,272	282,308
Brazoria	45,259	46,049	46,323	46,604	47,037	47,489	47,962	48,461	48,989	49,540	50,116
Brazos	29,737	29,802	29,903	30,032	30,115	30,199	30,285	30,378	30,473	30,568	30,665
Collin	102,433	103,234	103,653	103,913	104,402	104,914	105,439	105,947	106,504	107,066	107,667
Dallas	331,106	335,523	336,373	337,413	338,922	340,493	342,155	343,866	345,624	347,459	349,373
Denton	84,214	84,629	85,030	85,457	85,951	86,459	86,999	87,582	88,189	88,813	89,476
El Paso	139,921	140,067	140,239	140,337	140,480	140,627	140,778	140,936	141,100	141,264	141,443
Ellis	25,241	25,366	25,580	25,713	25,870	26,036	26,211	26,391	26,578	26,782	26,990
Fort Bend	77,980	79,102	79,714	80,179	80,693	81,231	81,809	82,385	83,016	83,689	84,407
Galveston	49,274	49,937	50,243	50,533	50,903	51,277	51,658	52,042	52,439	52,827	53,219
Harris	454,416	457,958	459,759	461,560	463,921	466,290	468,736	471,366	474,079	476,714	479,594
Hidalgo	103,752	104,273	104,685	105,205	105,613	106,021	106,434	106,853	107,275	107,695	108,129
Johnson	21,896	21,963	22,062	22,218	22,330	22,446	22,567	22,698	22,834	22,973	23,117
Lubbock	53,368	53,513	53,736	53,925	54,144	54,368	54,597	54,829	55,075	55,322	55,580
McLennan	30,940	30,940	30,940	30,940	31,010	31,077	31,140	31,200	31,263	31,321	31,375
Montgomery	65,505	66,267	67,028	67,028	67,593	68,167	68,769	69,394	70,038	70,733	71,427
Tarrant	287,244	288,627	289,659	290,845	292,139	293,517	294,935	296,426	297,988	299,578	301,274
Travis	96,009	96,668	97,515	98,256	98,838	99,450	100,087	100,742	101,417	102,124	102,856
Williamson	56,780	57,527	57,975	58,339	58,799	59,275	59,760	60,257	60,774	61,292	61,832

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:											
	8/16	8/17	8/18	8/19	8/21				8/23				8/25			
Bexar	264,238	266,027	267,630	268,970	272,552	(54,510)	[13,082]	{6,541}	276,304	(55,261)	[13,263]	{6,631}	280,272	(56,054)	[13,453]	{6,727}
Brazoria	45,259	46,049	46,323	46,604	47,489	(9,498)	[2,279]	{1,140}	48,461	(9,692)	[2,326]	{1,163}	49,540	(9,908)	[2,378]	{1,189}
Brazos	29,737	29,802	29,903	30,032	30,199	(6,040)	[1,450]	{725}	30,378	(6,076)	[1,458]	{729}	30,568	(6,114)	[1,467]	{734}
Collin	102,433	103,234	103,653	103,913	104,914	(20,983)	[5,036]	{2,518}	105,947	(21,189)	[5,085]	{2,543}	107,066	(21,413)	[5,139]	{2,570}
Dallas	331,106	335,523	336,373	337,413	340,493	(68,099)	[16,344]	{8,172}	343,866	(68,773)	[16,506]	{8,253}	347,459	(69,492)	[16,678]	{8,339}
Denton	84,214	84,629	85,030	85,457	86,459	(17,292)	[4,150]	{2,075}	87,582	(17,516)	[4,204]	{2,102}	88,813	(17,763)	[4,263]	{2,132}
El Paso	139,921	140,067	140,239	140,337	140,627	(28,125)	[6,750]	{3,375}	140,936	(28,187)	[6,765]	{3,382}	141,264	(28,253)	[6,781]	{3,390}
Ellis	25,241	25,366	25,580	25,713	26,036	(5,207)	[1,250]	{625}	26,391	(5,278)	[1,267]	{633}	26,782	(5,356)	[1,286]	{643}
Fort Bend	77,980	79,102	79,714	80,179	81,231	(16,246)	[3,899]	{1,950}	82,385	(16,477)	[3,954]	{1,977}	83,689	(16,738)	[4,017]	{2,009}
Galveston	49,274	49,937	50,243	50,533	51,277	(10,255)	[2,461]	{1,231}	52,042	(10,408)	[2,498]	{1,249}	52,827	(10,565)	[2,536]	{1,268}
Harris	454,416	457,958	459,759	461,560	466,290	(93,258)	[22,382]	{11,191}	471,366	(94,273)	[22,626]	{11,313}	476,714	(95,343)	[22,882]	{11,441}
Hidalgo	103,752	104,273	104,685	105,205	106,021	(21,204)	[5,089]	{2,545}	106,853	(21,371)	[5,129]	{2,564}	107,695	(21,539)	[5,169]	{2,585}
Johnson	21,896	21,963	22,062	22,218	22,446	(4,489)	[1,077]	{539}	22,698	(4,540)	[1,090]	{545}	22,973	(4,595)	[1,103]	{551}
Lubbock	53,368	53,513	53,736	53,925	54,368	(10,874)	[2,610]	{1,305}	54,829	(10,966)	[2,632]	{1,316}	55,322	(11,064)	[2,655]	{1,328}
McLennan	30,940	30,940	30,940	30,940	31,077	(6,215)	[1,492]	{746}	31,200	(6,240)	[1,498]	{749}	31,321	(6,264)	[1,503]	{752}
Montgomery	65,505	66,267	67,028	67,028	68,167	(13,633)	[3,272]	{1,636}	69,394	(13,879)	[3,331]	{1,665}	70,733	(14,147)	[3,395]	{1,698}
Tarrant	287,244	288,627	289,659	290,845	293,517	(58,703)	[14,089]	{7,044}	296,426	(59,285)	[14,228]	{7,114}	299,578	(59,916)	[14,380]	{7,190}
Travis	96,009	96,668	97,515	98,256	99,450	(19,890)	[4,774]	{2,387}	100,742	(20,148)	[4,836]	{2,418}	102,124	(20,425)	[4,902]	{2,451}
Williamson	56,780	57,527	57,975	58,339	59,275	(11,855)	[2,845]	{1,423}	60,257	(12,051)	[2,892]	{1,446}	61,292	(12,258)	[2,942]	{1,471}

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.