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

Date: 1/22/21

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 1/22/21 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.

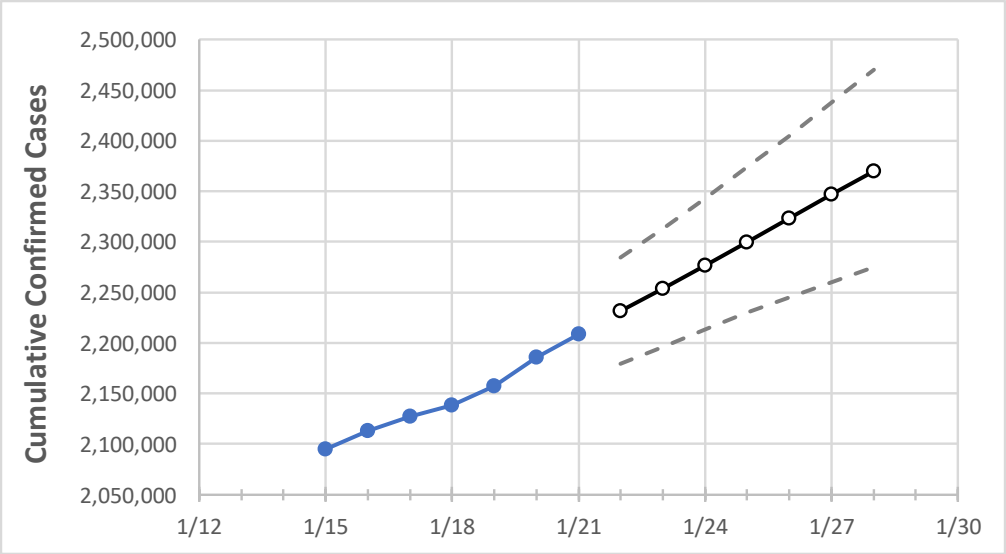
IEM's Modeling Lead

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:						
	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28
Texas	2,138,190	2,157,459	2,185,554	2,208,871	2,231,266	2,253,928	2,276,838	2,299,883	2,323,223	2,346,683	2,370,215

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:						
	1/18	1/19	1/20	1/21	1/22	1/23	1/24	1/25	1/26	1/27	1/28
Bexar	149,836	152,231	153,081	155,588	157,827	160,119	162,407	164,759	167,164	169,647	172,079
Brazoria	25,906	26,114	26,336	26,750	27,012	27,279	27,551	27,816	28,082	28,353	28,619
Brazos	16,980	17,093	17,226	17,371	17,527	17,684	17,843	18,003	18,164	18,325	18,483
Collin	63,842	64,721	65,420	66,040	66,825	67,622	68,417	69,212	69,991	70,741	71,497
Dallas	235,420	236,214	239,683	241,661	243,772	245,871	247,946	250,043	252,100	254,156	256,212
Denton	46,981	47,336	48,196	48,945	49,511	50,089	50,674	51,274	51,895	52,519	53,150
El Paso	107,191	107,552	108,561	108,561	109,094	109,653	110,219	110,790	111,347	111,945	112,572
Ellis	16,805	17,006	17,207	17,297	17,478	17,662	17,840	18,018	18,195	18,369	18,542
Fort Bend	44,067	45,514	46,287	46,639	47,238	47,857	48,519	49,140	49,811	50,514	51,218
Galveston	27,175	27,452	27,729	27,834	28,185	28,541	28,895	29,250	29,608	29,969	30,331
Harris	286,356	287,753	290,249	293,271	296,416	299,610	302,900	306,200	309,464	312,790	316,171
Hidalgo	57,846	58,015	58,754	59,504	59,972	60,434	60,927	61,410	61,912	62,431	62,930
Johnson	14,767	14,932	15,098	15,235	15,440	15,651	15,860	16,076	16,290	16,502	16,716
Lubbock	45,490	45,600	45,717	45,876	46,003	46,128	46,240	46,356	46,470	46,577	46,680
McLennan	22,027	22,159	22,292	22,373	22,529	22,679	22,834	22,986	23,138	23,292	23,442
Montgomery	34,069	34,423	34,719	35,171	35,575	35,979	36,372	36,769	37,165	37,566	37,961
Tarrant	195,518	197,447	199,521	201,310	203,708	206,186	208,539	211,033	213,538	216,087	218,562
Travis	61,468	62,302	63,036	63,751	64,480	65,217	65,976	66,751	67,534	68,313	69,128
Williamson	31,001	31,403	31,788	32,571	33,109	33,660	34,218	34,775	35,355	35,941	36,528

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:		
	1/18	1/19	1/20	1/21	1/23	1/25	1/27
Bexar	149,836	152,231	153,081	155,588	160,119 (32,024) [7,686] {3,843}	164,759 (32,952) [7,908] {3,954}	169,647 (33,929) [8,143] {4,072}
Brazoria	25,906	26,114	26,336	26,750	27,279 (5,456) [1,309] {655}	27,816 (5,563) [1,335] {668}	28,353 (5,671) [1,361] {680}
Brazos	16,980	17,093	17,226	17,371	17,684 (3,537) [849] {424}	18,003 (3,601) [864] {432}	18,325 (3,665) [880] {440}
Collin	63,842	64,721	65,420	66,040	67,622 (13,524) [3,246] {1,623}	69,212 (13,842) [3,322] {1,661}	70,741 (14,148) [3,396] {1,698}
Dallas	235,420	236,214	239,683	241,661	245,871 (49,174) [11,802] {5,901}	250,043 (50,009) [12,002] {6,001}	254,156 (50,831) [12,200] {6,100}
Denton	46,981	47,336	48,196	48,945	50,089 (10,018) [2,404] {1,202}	51,274 (10,255) [2,461] {1,231}	52,519 (10,504) [2,521] {1,260}
El Paso	107,191	107,552	108,561	108,561	109,653 (21,931) [5,263] {2,632}	110,790 (22,158) [5,318] {2,659}	111,945 (22,389) [5,373] {2,687}
Ellis	16,805	17,006	17,207	17,297	17,662 (3,532) [848] {424}	18,018 (3,604) [865] {432}	18,369 (3,674) [882] {441}
Fort Bend	44,067	45,514	46,287	46,639	47,857 (9,571) [2,297] {1,149}	49,140 (9,828) [2,359] {1,179}	50,514 (10,103) [2,425] {1,212}
Galveston	27,175	27,452	27,729	27,834	28,541 (5,708) [1,370] {685}	29,250 (5,850) [1,404] {702}	29,969 (5,994) [1,438] {719}
Harris	286,356	287,753	290,249	293,271	299,610 (59,922) [14,381] {7,191}	306,200 (61,240) [14,698] {7,349}	312,790 (62,558) [15,014] {7,507}
Hidalgo	57,846	58,015	58,754	59,504	60,434 (12,087) [2,901] {1,450}	61,410 (12,282) [2,948] {1,474}	62,431 (12,486) [2,997] {1,498}
Johnson	14,767	14,932	15,098	15,235	15,651 (3,130) [751] {376}	16,076 (3,215) [772] {386}	16,502 (3,300) [792] {396}
Lubbock	45,490	45,600	45,717	45,876	46,128 (9,226) [2,214] {1,107}	46,356 (9,271) [2,225] {1,113}	46,577 (9,315) [2,236] {1,118}
McLennan	22,027	22,159	22,292	22,373	22,679 (4,536) [1,089] {544}	22,986 (4,597) [1,103] {552}	23,292 (4,658) [1,118] {559}
Montgomery	34,069	34,423	34,719	35,171	35,979 (7,196) [1,727] {863}	36,769 (7,354) [1,765] {882}	37,566 (7,513) [1,803] {902}
Tarrant	195,518	197,447	199,521	201,310	206,186 (41,237) [9,897] {4,948}	211,033 (42,207) [10,130] {5,065}	216,087 (43,217) [10,372] {5,186}
Travis	61,468	62,302	63,036	63,751	65,217 (13,043) [3,130] {1,565}	66,751 (13,350) [3,204] {1,602}	68,313 (13,663) [3,279] {1,640}
Williamson	31,001	31,403	31,788	32,571	33,660 (6,732) [1,616] {808}	34,775 (6,955) [1,669] {835}	35,941 (7,188) [1,725] {863}

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.