IEM's AI Modeling: Short-term COVID-19 Projections
Date: 9/22/21

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 <u>not</u> 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 9/22/21 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.
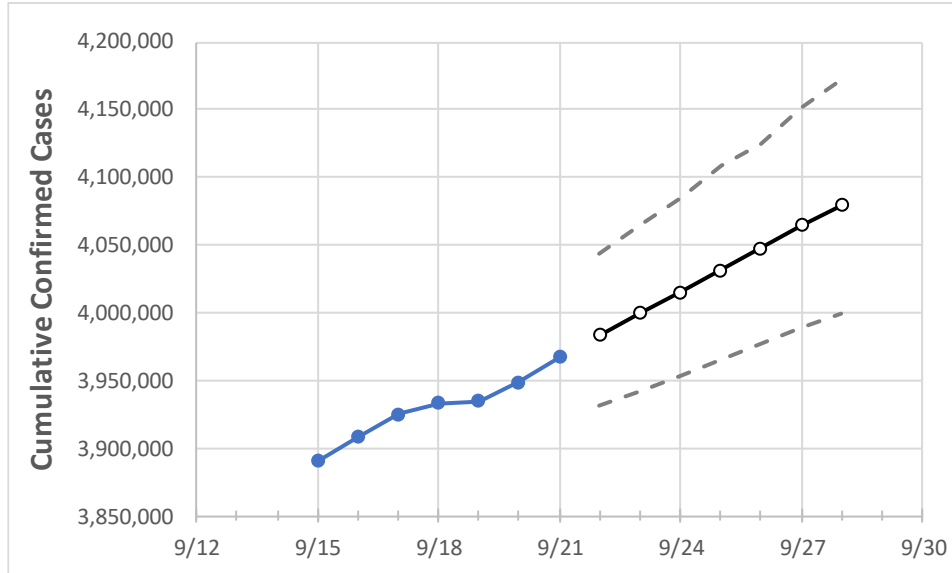
IEM's Modeling Lead

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:						
	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28
Texas	3,933,083	3,934,628	3,949,052	3,967,426	3,983,538	3,999,330	4,015,189	4,031,463	4,047,542	4,064,397	4,079,161

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:						
	9/18	9/19	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28
Bexar	303,621	304,277	304,934	305,278	305,957	306,621	307,285	307,906	308,552	309,142	309,734
Brazoria	55,977	56,068	56,159	56,269	56,562	56,855	57,124	57,402	57,680	57,963	58,255
Brazos	33,678	33,820	33,961	34,209	34,397	34,587	34,788	34,989	35,199	35,409	35,630
Collin	120,640	120,808	120,916	121,267	121,698	122,143	122,545	122,975	123,392	123,802	124,239
Dallas	376,007	376,405	376,804	380,124	381,445	382,981	384,373	385,745	387,249	388,811	390,280
Denton	96,533	96,760	96,986	97,522	97,965	98,405	98,851	99,294	99,750	100,205	100,673
El Paso	143,810	143,880	143,944	144,015	144,101	144,188	144,272	144,358	144,443	144,525	144,609
Ellis	30,145	30,248	30,350	30,453	30,592	30,726	30,858	30,993	31,124	31,252	31,386
Fort Bend	91,834	91,915	91,995	92,857	93,313	93,706	94,125	94,588	95,044	95,461	95,897
Galveston	59,974	60,163	60,354	60,545	60,784	61,016	61,248	61,474	61,699	61,922	62,141
Harris	538,840	539,494	540,055	542,092	544,055	545,937	547,766	549,864	551,750	553,655	555,646
Hidalgo	112,522	112,645	112,767	113,156	113,402	113,625	113,870	114,100	114,352	114,592	114,831
Johnson	25,298	25,372	25,447	25,521	25,632	25,749	25,864	25,977	26,095	26,212	26,326
Lubbock	62,104	62,211	62,319	62,426	62,676	62,929	63,162	63,407	63,648	63,884	64,124
McLennan	39,131	39,255	39,378	39,502	39,743	39,972	40,201	40,440	40,669	40,899	41,133
Montgomery	82,323	82,576	82,829	82,829	83,141	83,446	83,737	84,032	84,307	84,591	84,859
Tarrant	333,765	335,044	336,324	337,510	339,443	341,314	343,234	345,184	347,132	349,202	351,329
Travis	112,266	112,443	112,620	113,132	113,538	113,910	114,301	114,684	115,059	115,440	115,793
Williamson	69,662	69,828	69,994	70,222	70,509	70,817	71,088	71,384	71,672	71,950	72,237

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:		
	9/18	9/19	9/20	9/21	9/23	9/25	9/27
Bexar	303,621	304,277	304,934	305,278	306,621 (61,324) [14,718] {7,359}	307,906 (61,581) [14,779] {7,390}	309,142 (61,828) [14,839] {7,419}
Brazoria	55,977	56,068	56,159	56,269	56,855 (11,371) [2,729] {1,365}	57,402 (11,480) [2,755] {1,378}	57,963 (11,593) [2,782] {1,391}
Brazos	33,678	33,820	33,961	34,209	34,587 (6,917) [1,660] {830}	34,989 (6,998) [1,679] {840}	35,409 (7,082) [1,700] {850}
Collin	120,640	120,808	120,916	121,267	122,143 (24,429) [5,863] {2,931}	122,975 (24,595) [5,903] {2,951}	123,802 (24,760) [5,943] {2,971}
Dallas	376,007	376,405	376,804	380,124	382,981 (76,596) [18,383] {9,192}	385,745 (77,149) [18,516] {9,258}	388,811 (77,762) [18,663] {9,331}
Denton	96,533	96,760	96,986	97,522	98,405 (19,681) [4,723] {2,362}	99,294 (19,859) [4,766] {2,383}	100,205 (20,041) [4,810] {2,405}
El Paso	143,810	143,880	143,944	144,015	144,188 (28,838) [6,921] {3,461}	144,358 (28,872) [6,929] {3,465}	144,525 (28,905) [6,937] {3,469}
Ellis	30,145	30,248	30,350	30,453	30,726 (6,145) [1,475] {737}	30,993 (6,199) [1,488] {744}	31,252 (6,250) [1,500] {750}
Fort Bend	91,834	91,915	91,995	92,857	93,706 (18,741) [4,498] {2,249}	94,588 (18,918) [4,540] {2,270}	95,461 (19,092) [4,582] {2,291}
Galveston	59,974	60,163	60,354	60,545	61,016 (12,203) [2,929] {1,464}	61,474 (12,295) [2,951] {1,475}	61,922 (12,384) [2,972] {1,486}
Harris	538,840	539,494	540,055	542,092	545,937 (109,187) [26,205] {13,102}	549,864 (109,973) [26,393] {13,197}	553,655 (110,731) [26,575] {13,288}
Hidalgo	112,522	112,645	112,767	113,156	113,625 (22,725) [5,454] {2,727}	114,100 (22,820) [5,477] {2,738}	114,592 (22,918) [5,500] {2,750}
Johnson	25,298	25,372	25,447	25,521	25,749 (5,150) [1,236] {618}	25,977 (5,195) [1,247] {623}	26,212 (5,242) [1,258] {629}
Lubbock	62,104	62,211	62,319	62,426	62,929 (12,586) [3,021] {1,510}	63,407 (12,681) [3,044] {1,522}	63,884 (12,777) [3,066] {1,533}
McLennan	39,131	39,255	39,378	39,502	39,972 (7,994) [1,919] {959}	40,440 (8,088) [1,941] {971}	40,899 (8,180) [1,963] {982}
Montgomery	82,323	82,576	82,829	82,829	83,446 (16,689) [4,005] {2,003}	84,032 (16,806) [4,034] {2,017}	84,591 (16,918) [4,060] {2,030}
Tarrant	333,765	335,044	336,324	337,510	341,314 (68,263) [16,383] {8,192}	345,184 (69,037) [16,569] {8,284}	349,202 (69,840) [16,762] {8,381}
Travis	112,266	112,443	112,620	113,132	113,910 (22,782) [5,468] {2,734}	114,684 (22,937) [5,505] {2,752}	115,440 (23,088) [5,541] {2,771}
Williamson	69,662	69,828	69,994	70,222	70,817 (14,163) [3,399] {1,700}	71,384 (14,277) [3,426] {1,713}	71,950 (14,390) [3,454] {1,727}

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.