IEM's AI Modeling: Short-term COVID-19 Projections
Date: 9/3/21

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 9/3/21 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
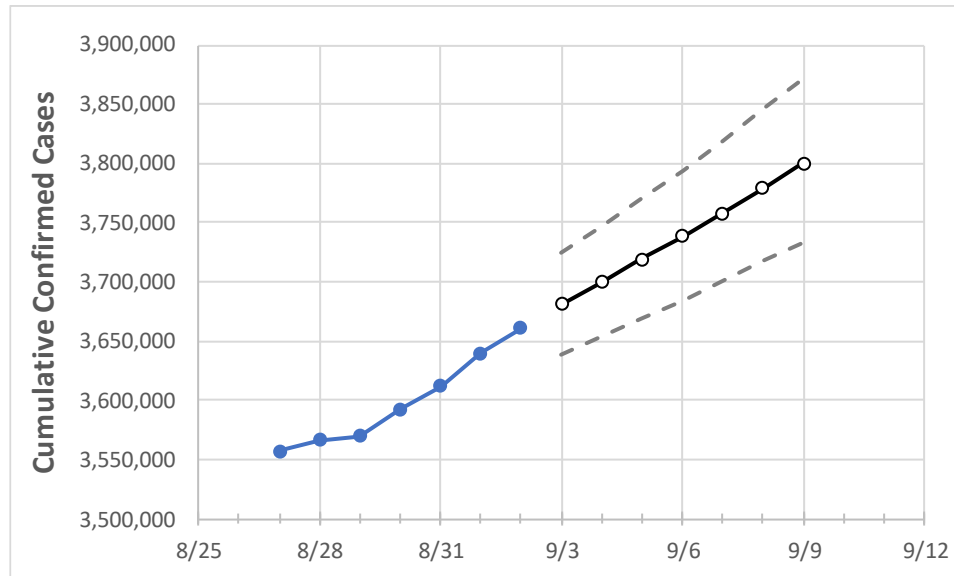
	Actual Confirmed Cases On:				Projected Cases For:						
	8/30	8/31	9/1	9/2	9/3	9/4	9/5	9/6	9/7	9/8	9/9
Texas	3,592,504	3,612,246	3,639,659	3,661,241	3,680,803	3,699,802	3,719,056	3,738,368	3,757,981	3,778,825	3,800,248

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:						
	8/30	8/31	9/1	9/2	9/3	9/4	9/5	9/6	9/7	9/8	9/9
Bexar	282,909	283,773	285,730	287,411	288,774	290,177	291,529	292,905	294,298	295,667	297,054
Brazoria	49,781	49,801	50,450	51,251	51,625	51,982	52,357	52,726	53,112	53,505	53,892
Brazos	30,997	31,137	31,301	31,301	31,423	31,542	31,663	31,788	31,916	32,052	32,186
Collin	108,946	109,432	110,296	111,426	112,068	112,687	113,360	114,034	114,700	115,431	116,131
Dallas	348,868	351,216	353,564	356,069	357,572	359,176	360,710	362,363	364,037	365,664	367,408
Denton	88,916	89,374	89,790	90,124	90,479	90,825	91,184	91,536	91,901	92,279	92,631
El Paso	141,865	141,949	142,086	142,206	142,349	142,488	142,626	142,775	142,918	143,061	143,208
Ellis	26,897	26,996	27,128	27,410	27,551	27,689	27,837	27,981	28,132	28,291	28,442
Fort Bend	83,286	84,184	84,453	85,229	85,624	86,046	86,471	86,879	87,335	87,775	88,231
Galveston	54,176	54,408	54,774	55,056	55,397	55,718	56,055	56,378	56,709	57,052	57,388
Harris	495,842	497,077	501,798	503,065	505,980	508,944	511,896	515,090	518,062	521,549	524,762
Hidalgo	107,911	108,257	108,717	108,975	109,241	109,509	109,777	110,048	110,308	110,587	110,841
Johnson	22,980	23,048	23,121	23,278	23,364	23,448	23,534	23,617	23,707	23,798	23,888
Lubbock	56,366	56,598	56,878	57,357	57,652	57,963	58,285	58,613	58,937	59,287	59,632
McLennan	34,061	34,242	34,450	34,951	35,200	35,463	35,711	35,978	36,245	36,532	36,810
Montgomery	72,636	73,186	73,736	73,736	74,278	74,834	75,376	75,945	76,515	77,099	77,684
Tarrant	303,506	304,310	305,996	307,455	308,875	310,293	311,722	313,191	314,695	316,249	317,828
Travis	103,169	103,893	104,530	105,250	105,827	106,395	106,983	107,558	108,182	108,783	109,389
Williamson	61,861	62,449	63,067	63,783	64,259	64,738	65,226	65,715	66,204	66,727	67,236

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:		
	8/30	8/31	9/1	9/2	9/4	9/6	9/8
Bexar	282,909	283,773	285,730	287,411	290,177 (58,035) [13,929] {6,964}	292,905 (58,581) [14,059] {7,030}	295,667 (59,133) [14,192] {7,096}
Brazoria	49,781	49,801	50,450	51,251	51,982 (10,396) [2,495] {1,248}	52,726 (10,545) [2,531] {1,265}	53,505 (10,701) [2,568] {1,284}
Brazos	30,997	31,137	31,301	31,301	31,542 (6,308) [1,514] {757}	31,788 (6,358) [1,526] {763}	32,052 (6,410) [1,538] {769}
Collin	108,946	109,432	110,296	111,426	112,687 (22,537) [5,409] {2,704}	114,034 (22,807) [5,474] {2,737}	115,431 (23,086) [5,541] {2,770}
Dallas	348,868	351,216	353,564	356,069	359,176 (71,835) [17,240] {8,620}	362,363 (72,473) [17,393] {8,697}	365,664 (73,133) [17,552] {8,776}
Denton	88,916	89,374	89,790	90,124	90,825 (18,165) [4,360] {2,180}	91,536 (18,307) [4,394] {2,197}	92,279 (18,456) [4,429] {2,215}
El Paso	141,865	141,949	142,086	142,206	142,488 (28,498) [6,839] {3,420}	142,775 (28,555) [6,853] {3,427}	143,061 (28,612) [6,867] {3,433}
Ellis	26,897	26,996	27,128	27,410	27,689 (5,538) [1,329] {665}	27,981 (5,596) [1,343] {672}	28,291 (5,658) [1,358] {679}
Fort Bend	83,286	84,184	84,453	85,229	86,046 (17,209) [4,130] {2,065}	86,879 (17,376) [4,170] {2,085}	87,775 (17,555) [4,213] {2,107}
Galveston	54,176	54,408	54,774	55,056	55,718 (11,144) [2,674] {1,337}	56,378 (11,276) [2,706] {1,353}	57,052 (11,410) [2,739] {1,369}
Harris	495,842	497,077	501,798	503,065	508,944 (101,789) [24,429] {12,215}	515,090 (103,018) [24,724] {12,362}	521,549 (104,310) [25,034] {12,517}
Hidalgo	107,911	108,257	108,717	108,975	109,509 (21,902) [5,256] {2,628}	110,048 (22,010) [5,282] {2,641}	110,587 (22,117) [5,308] {2,654}
Johnson	22,980	23,048	23,121	23,278	23,448 (4,690) [1,126] {563}	23,617 (4,723) [1,134] {567}	23,798 (4,760) [1,142] {571}
Lubbock	56,366	56,598	56,878	57,357	57,963 (11,593) [2,782] {1,391}	58,613 (11,723) [2,813] {1,407}	59,287 (11,857) [2,846] {1,423}
McLennan	34,061	34,242	34,450	34,951	35,463 (7,093) [1,702] {851}	35,978 (7,196) [1,727] {863}	36,532 (7,306) [1,754] {877}
Montgomery	72,636	73,186	73,736	73,736	74,834 (14,967) [3,592] {1,796}	75,945 (15,189) [3,645] {1,823}	77,099 (15,420) [3,701] {1,850}
Tarrant	303,506	304,310	305,996	307,455	310,293 (62,059) [14,894] {7,447}	313,191 (62,638) [15,033] {7,517}	316,249 (63,250) [15,180] {7,590}
Travis	103,169	103,893	104,530	105,250	106,395 (21,279) [5,107] {2,553}	107,558 (21,512) [5,163] {2,581}	108,783 (21,757) [5,222] {2,611}
Williamson	61,861	62,449	63,067	63,783	64,738 (12,948) [3,107] {1,554}	65,715 (13,143) [3,154] {1,577}	66,727 (13,345) [3,203] {1,601}

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.