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

Date: 7/28/20

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 20%, and are often within 10%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 7/28/20 11 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.

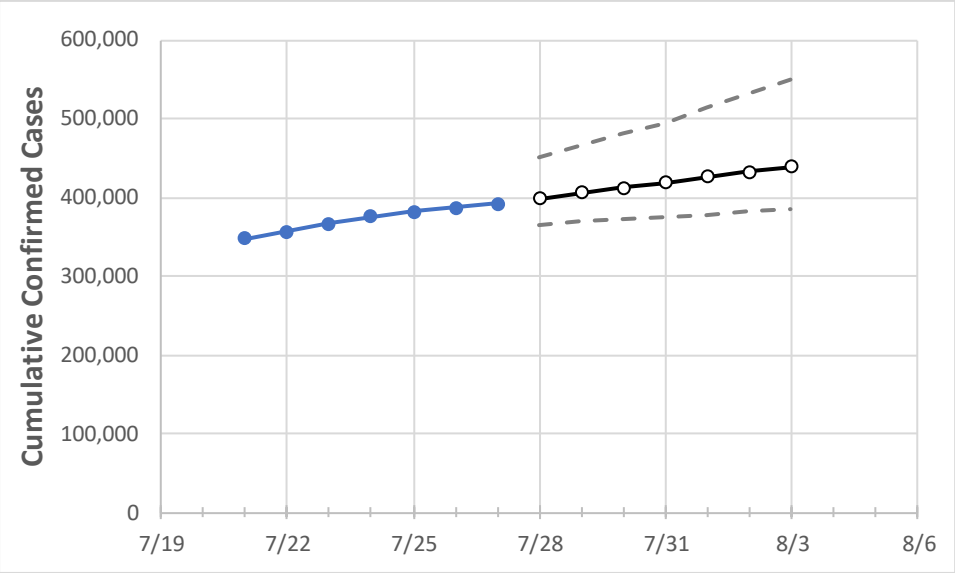
IEM's Modeling Lead

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:						
	7/24	7/25	7/26	7/27	7/28	7/29	7/30	7/31	8/1	8/2	8/3
Texas	375,359	381,808	387,415	391,832	398,760	405,613	412,391	419,098	425,735	432,304	438,808

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 20%, and are often within 10%, of actual confirmed cases.

Texas Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	7/24	7/25	7/26	7/27	7/28	7/29	7/30	7/31	8/1	8/2	8/3
Bexar	34,932	35,690	36,083	36,438	37,060	37,678	38,291	38,899	39,502	40,101	40,695
Brazoria	5,277	5,299	5,443	5,573	5,671	5,769	5,866	5,963	6,059	6,155	6,251
Brazos	3,571	3,635	3,688	3,724	3,763	3,802	3,840	3,878	3,915	3,952	3,989
Collin	5,709	5,735	5,762	5,789	5,835	5,878	5,920	5,960	5,998	6,034	6,069
Dallas	44,087	44,746	46,013	46,813	47,557	48,294	49,021	49,741	50,451	51,154	51,848
Denton	5,723	5,915	6,043	6,121	6,295	6,476	6,664	6,859	7,062	7,273	7,492
El Paso	12,750	12,971	13,240	13,240	13,471	13,700	13,929	14,157	14,383	14,609	14,833
Ellis	2,216	2,268	2,268	2,268	2,307	2,347	2,386	2,425	2,464	2,503	2,542
Fort Bend	6,352	6,460	6,530	6,530	6,607	6,685	6,764	6,844	6,924	7,005	7,087
Galveston	7,794	7,914	8,046	8,046	8,166	8,284	8,401	8,516	8,629	8,741	8,852
Harris	61,416	62,619	64,113	65,349	66,712	68,089	69,480	70,885	72,305	73,740	75,189
Hidalgo	14,589	15,153	15,153	15,153	16,180	16,696	17,178	17,669	18,154	18,665	19,116
Johnson	1,179	1,234	1,234	1,234	1,280	1,328	1,378	1,430	1,484	1,541	1,601
Lubbock	4,880	4,962	5,014	5,100	5,180	5,260	5,340	5,419	5,498	5,577	5,656
McLennan	3,782	3,885	3,957	3,986	4,070	4,155	4,242	4,329	4,418	4,507	4,598
Montgomery	5,444	5,597	5,597	5,597	5,814	5,920	6,030	6,143	6,258	6,364	6,469
Tarrant	23,967	24,562	25,146	25,499	25,993	26,493	26,999	27,512	28,031	28,558	29,091
Travis	18,939	19,177	19,401	19,480	19,672	19,857	20,037	20,210	20,379	20,542	20,699
Williamson	5,145	5,203	5,246	5,304	5,371	5,437	5,501	5,564	5,625	5,685	5,744

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:		
	7/24	7/25	7/26	7/27	7/29	7/31	8/2
Bexar	34,932	35,690	36,083	36,438	37,678 (7,536) [1,809] {904}	38,899 (7,780) [1,867] {934}	40,101 (8,020) [1,925] {962}
Brazoria	5,277	5,299	5,443	5,573	5,769 (1,154) [277] {138}	5,963 (1,193) [286] {143}	6,155 (1,231) [295] {148}
Brazos	3,571	3,635	3,688	3,724	3,802 (760) [182] {91}	3,878 (776) [186] {93}	3,952 (790) [190] {95}
Collin	5,709	5,735	5,762	5,789	5,878 (1,176) [282] {141}	5,960 (1,192) [286] {143}	6,034 (1,207) [290] {145}
Dallas	44,087	44,746	46,013	46,813	48,294 (9,659) [2,318] {1,159}	49,741 (9,948) [2,388] {1,194}	51,154 (10,231) [2,455] {1,228}
Denton	5,723	5,915	6,043	6,121	6,476 (1,295) [311] {155}	6,859 (1,372) [329] {165}	7,273 (1,455) [349] {175}
El Paso	12,750	12,971	13,240	13,240	13,700 (2,740) [658] {329}	14,157 (2,831) [680] {340}	14,609 (2,922) [701] {351}
Ellis	2,216	2,268	2,268	2,268	2,347 (469) [113] {56}	2,425 (485) [116] {58}	2,503 (501) [120] {60}
Fort Bend	6,352	6,460	6,530	6,530	6,685 (1,337) [321] {160}	6,844 (1,369) [328] {164}	7,005 (1,401) [336] {168}
Galveston	7,794	7,914	8,046	8,046	8,284 (1,657) [398] {199}	8,516 (1,703) [409] {204}	8,741 (1,748) [420] {210}
Harris	61,416	62,619	64,113	65,349	68,089 (13,618) [3,268] {1,634}	70,885 (14,177) [3,402] {1,701}	73,740 (14,748) [3,540] {1,770}
Hidalgo	14,589	15,153	15,153	15,153	16,696 (3,339) [801] {401}	17,669 (3,534) [848] {424}	18,665 (3,733) [896] {448}
Johnson	1,179	1,234	1,234	1,234	1,328 (266) [64] {32}	1,430 (286) [69] {34}	1,541 (308) [74] {37}
Lubbock	4,880	4,962	5,014	5,100	5,260 (1,052) [252] {126}	5,419 (1,084) [260] {130}	5,577 (1,115) [268] {134}
McLennan	3,782	3,885	3,957	3,986	4,155 (831) [199] {100}	4,329 (866) [208] {104}	4,507 (901) [216] {108}
Montgomery	5,444	5,597	5,597	5,597	5,920 (1,184) [284] {142}	6,143 (1,229) [295] {147}	6,364 (1,273) [305] {153}
Tarrant	23,967	24,562	25,146	25,499	26,493 (5,299) [1,272] {636}	27,512 (5,502) [1,321] {660}	28,558 (5,712) [1,371] {685}
Travis	18,939	19,177	19,401	19,480	19,857 (3,971) [953] {477}	20,210 (4,042) [970] {485}	20,542 (4,108) [986] {493}
Williamson	5,145	5,203	5,246	5,304	5,437 (1,087) [261] {130}	5,564 (1,113) [267] {134}	5,685 (1,137) [273] {136}

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.