IEM's AI Modeling: Short-term COVID-19 Projections
Date: 3/10/21

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 3/10/21 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
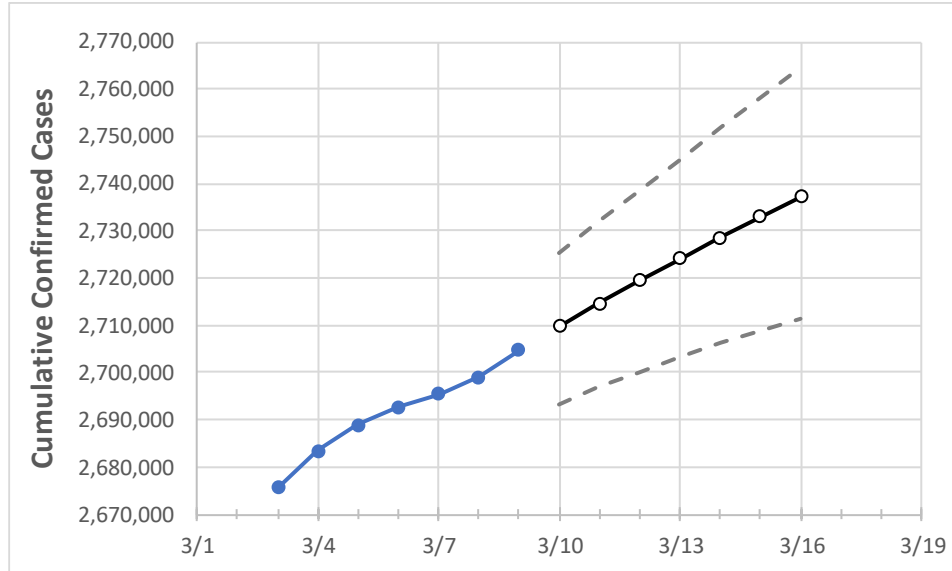
	Actual Confirmed Cases On:				Projected Cases For:						
	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16
Texas	2,692,691	2,695,558	2,699,083	2,704,712	2,709,740	2,714,690	2,719,532	2,724,197	2,728,580	2,732,922	2,737,146

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:						
	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16
Bexar	197,921	198,568	198,798	198,969	199,207	199,439	199,654	199,855	200,053	200,235	200,424
Brazoria	33,560	33,669	33,698	33,839	33,945	34,047	34,150	34,254	34,356	34,458	34,552
Brazos	21,485	21,508	21,531	21,587	21,649	21,711	21,773	21,834	21,897	21,957	22,016
Collin	83,890	83,990	84,151	84,309	84,422	84,527	84,625	84,723	84,813	84,895	84,977
Dallas	284,010	284,318	284,627	284,935	285,376	285,806	286,247	286,689	287,121	287,536	287,931
Denton	67,158	67,467	67,776	68,236	68,708	69,168	69,639	70,102	70,586	71,076	71,552
El Paso	125,250	125,372	125,542	125,830	126,036	126,244	126,449	126,644	126,842	127,030	127,218
Ellis	21,380	21,389	21,398	21,407	21,480	21,554	21,627	21,703	21,779	21,858	21,938
Fort Bend	59,331	59,373	59,414	59,821	60,017	60,207	60,403	60,600	60,799	60,998	61,194
Galveston	35,261	35,354	35,408	35,461	35,567	35,669	35,773	35,872	35,972	36,070	36,167
Harris	358,505	359,382	359,948	360,421	361,554	362,707	363,857	364,966	366,086	367,273	368,429
Hidalgo	78,822	78,874	78,926	79,142	79,344	79,533	79,714	79,884	80,049	80,212	80,360
Johnson	18,775	18,787	18,798	18,810	18,838	18,864	18,891	18,916	18,942	18,965	18,988
Lubbock	48,241	48,249	48,260	48,272	48,285	48,297	48,308	48,319	48,330	48,340	48,349
McLennan	25,335	25,352	25,370	25,387	25,418	25,447	25,476	25,503	25,530	25,554	25,578
Montgomery	46,244	46,389	46,534	46,713	46,872	47,026	47,183	47,339	47,496	47,652	47,810
Tarrant	244,795	244,957	245,385	245,629	246,005	246,363	246,729	247,077	247,408	247,732	248,048
Travis	76,507	76,638	76,742	76,855	76,975	77,089	77,201	77,309	77,410	77,514	77,609
Williamson	41,399	41,449	41,498	41,588	41,658	41,727	41,796	41,859	41,923	41,986	42,048

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:		
	3/6	3/7	3/8	3/9	3/11	3/13	3/15
Bexar	197,921	198,568	198,798	198,969	199,439 (39,888) [9,573] {4,787}	199,855 (39,971) [9,593] {4,797}	200,235 (40,047) [9,611] {4,806}
Brazoria	33,560	33,669	33,698	33,839	34,047 (6,809) [1,634] {817}	34,254 (6,851) [1,644] {822}	34,458 (6,892) [1,654] {827}
Brazos	21,485	21,508	21,531	21,587	21,711 (4,342) [1,042] {521}	21,834 (4,367) [1,048] {524}	21,957 (4,391) [1,054] {527}
Collin	83,890	83,990	84,151	84,309	84,527 (16,905) [4,057] {2,029}	84,723 (16,945) [4,067] {2,033}	84,895 (16,979) [4,075] {2,037}
Dallas	284,010	284,318	284,627	284,935	285,806 (57,161) [13,719] {6,859}	286,689 (57,338) [13,761] {6,881}	287,536 (57,507) [13,802] {6,901}
Denton	67,158	67,467	67,776	68,236	69,168 (13,834) [3,320] {1,660}	70,102 (14,020) [3,365] {1,682}	71,076 (14,215) [3,412] {1,706}
El Paso	125,250	125,372	125,542	125,830	126,244 (25,249) [6,060] {3,030}	126,644 (25,329) [6,079] {3,039}	127,030 (25,406) [6,097] {3,049}
Ellis	21,380	21,389	21,398	21,407	21,554 (4,311) [1,035] {517}	21,703 (4,341) [1,042] {521}	21,858 (4,372) [1,049] {525}
Fort Bend	59,331	59,373	59,414	59,821	60,207 (12,041) [2,890] {1,445}	60,600 (12,120) [2,909] {1,454}	60,998 (12,200) [2,928] {1,464}
Galveston	35,261	35,354	35,408	35,461	35,669 (7,134) [1,712] {856}	35,872 (7,174) [1,722] {861}	36,070 (7,214) [1,731] {866}
Harris	358,505	359,382	359,948	360,421	362,707 (72,541) [17,410] {8,705}	364,966 (72,993) [17,518] {8,759}	367,273 (73,455) [17,629] {8,815}
Hidalgo	78,822	78,874	78,926	79,142	79,533 (15,907) [3,818] {1,909}	79,884 (15,977) [3,834] {1,917}	80,212 (16,042) [3,850] {1,925}
Johnson	18,775	18,787	18,798	18,810	18,864 (3,773) [905] {453}	18,916 (3,783) [908] {454}	18,965 (3,793) [910] {455}
Lubbock	48,241	48,249	48,260	48,272	48,297 (9,659) [2,318] {1,159}	48,319 (9,664) [2,319] {1,160}	48,340 (9,668) [2,320] {1,160}
McLennan	25,335	25,352	25,370	25,387	25,447 (5,089) [1,221] {611}	25,503 (5,101) [1,224] {612}	25,554 (5,111) [1,227] {613}
Montgomery	46,244	46,389	46,534	46,713	47,026 (9,405) [2,257] {1,129}	47,339 (9,468) [2,272] {1,136}	47,652 (9,530) [2,287] {1,144}
Tarrant	244,795	244,957	245,385	245,629	246,363 (49,273) [11,825] {5,913}	247,077 (49,415) [11,860] {5,930}	247,732 (49,546) [11,891] {5,946}
Travis	76,507	76,638	76,742	76,855	77,089 (15,418) [3,700] {1,850}	77,309 (15,462) [3,711] {1,855}	77,514 (15,503) [3,721] {1,860}
Williamson	41,399	41,449	41,498	41,588	41,727 (8,345) [2,003] {1,001}	41,859 (8,372) [2,009] {1,005}	41,986 (8,397) [2,015] {1,008}

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.