IEM's AI Modeling: Short-term COVID-19 Projections
Date: 3/12/21

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 3/12/21 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
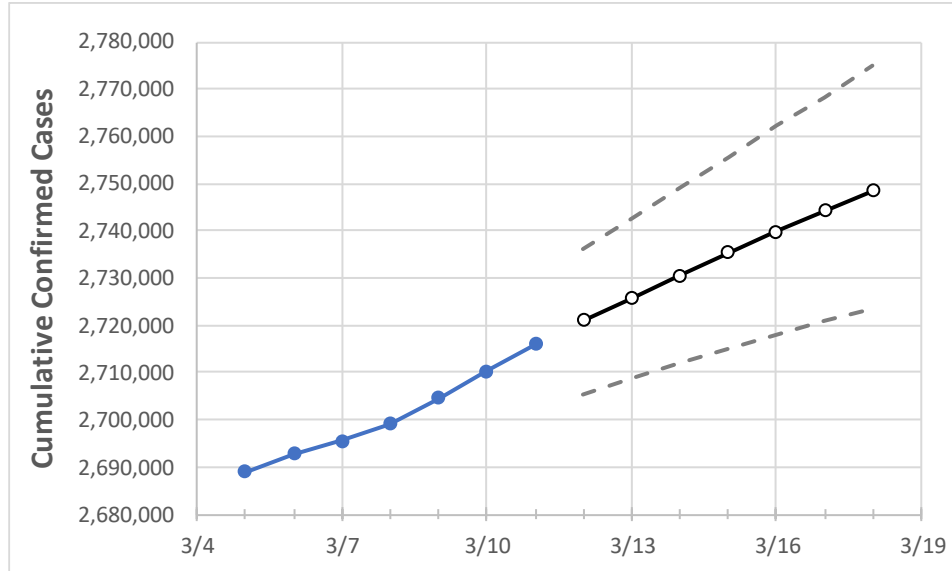
	Actual Confirmed Cases On:				Projected Cases For:						
	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16	3/17	3/18
Texas	2,699,083	2,704,712	2,710,278	2,715,993	2,721,017	2,725,815	2,730,563	2,735,345	2,739,894	2,744,306	2,748,573

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:						
	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16	3/17	3/18
Bexar	198,798	198,969	199,065	199,065	199,281	199,476	199,674	199,849	200,028	200,199	200,359
Brazoria	33,698	33,839	33,943	34,030	34,126	34,226	34,327	34,419	34,514	34,606	34,692
Brazos	21,531	21,587	21,701	21,825	21,900	21,975	22,053	22,132	22,211	22,291	22,373
Collin	84,151	84,309	84,589	84,729	84,848	84,963	85,075	85,181	85,289	85,389	85,480
Dallas	284,627	284,935	285,332	285,683	286,106	286,520	286,930	287,326	287,725	288,110	288,492
Denton	67,776	68,236	68,852	69,307	69,790	70,295	70,800	71,298	71,808	72,344	72,867
El Paso	125,542	125,830	125,985	126,210	126,409	126,608	126,796	126,981	127,167	127,339	127,501
Ellis	21,398	21,407	21,437	21,471	21,533	21,594	21,657	21,719	21,782	21,844	21,907
Fort Bend	59,414	59,821	60,499	60,594	60,851	61,114	61,382	61,644	61,905	62,160	62,451
Galveston	35,408	35,461	35,597	35,686	35,789	35,890	35,990	36,090	36,190	36,290	36,384
Harris	359,948	360,421	360,938	362,716	363,863	365,010	366,139	367,296	368,482	369,690	370,885
Hidalgo	78,926	79,142	79,380	79,637	79,834	80,018	80,197	80,364	80,543	80,707	80,867
Johnson	18,798	18,810	18,841	18,870	18,894	18,918	18,940	18,962	18,984	19,004	19,023
Lubbock	48,260	48,272	48,285	48,301	48,312	48,323	48,333	48,343	48,352	48,361	48,370
McLennan	25,370	25,387	25,428	25,455	25,484	25,512	25,539	25,564	25,588	25,611	25,633
Montgomery	46,534	46,713	46,794	46,993	47,142	47,291	47,441	47,589	47,736	47,880	48,027
Tarrant	245,385	245,629	246,077	246,510	246,868	247,215	247,556	247,892	248,220	248,550	248,850
Travis	76,742	76,855	77,082	77,231	77,358	77,487	77,609	77,734	77,854	77,974	78,088
Williamson	41,498	41,588	41,649	41,799	41,874	41,950	42,023	42,096	42,169	42,238	42,307

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:		
	3/8	3/9	3/10	3/11	3/13	3/15	3/17
Bexar	198,798	198,969	199,065	199,065	199,476 (39,895) [9,575] {4,787}	199,849 (39,970) [9,593] {4,796}	200,199 (40,040) [9,610] {4,805}
Brazoria	33,698	33,839	33,943	34,030	34,226 (6,845) [1,643] {821}	34,419 (6,884) [1,652] {826}	34,606 (6,921) [1,661] {831}
Brazos	21,531	21,587	21,701	21,825	21,975 (4,395) [1,055] {527}	22,132 (4,426) [1,062] {531}	22,291 (4,458) [1,070] {535}
Collin	84,151	84,309	84,589	84,729	84,963 (16,993) [4,078] {2,039}	85,181 (17,036) [4,089] {2,044}	85,389 (17,078) [4,099] {2,049}
Dallas	284,627	284,935	285,332	285,683	286,520 (57,304) [13,753] {6,876}	287,326 (57,465) [13,792] {6,896}	288,110 (57,622) [13,829] {6,915}
Denton	67,776	68,236	68,852	69,307	70,295 (14,059) [3,374] {1,687}	71,298 (14,260) [3,422] {1,711}	72,344 (14,469) [3,472] {1,736}
El Paso	125,542	125,830	125,985	126,210	126,608 (25,322) [6,077] {3,039}	126,981 (25,396) [6,095] {3,048}	127,339 (25,468) [6,112] {3,056}
Ellis	21,398	21,407	21,437	21,471	21,594 (4,319) [1,037] {518}	21,719 (4,344) [1,043] {521}	21,844 (4,369) [1,049] {524}
Fort Bend	59,414	59,821	60,499	60,594	61,114 (12,223) [2,933] {1,467}	61,644 (12,329) [2,959] {1,479}	62,160 (12,432) [2,984] {1,492}
Galveston	35,408	35,461	35,597	35,686	35,890 (7,178) [1,723] {861}	36,090 (7,218) [1,732] {866}	36,290 (7,258) [1,742] {871}
Harris	359,948	360,421	360,938	362,716	365,010 (73,002) [17,520] {8,760}	367,296 (73,459) [17,630] {8,815}	369,690 (73,938) [17,745] {8,873}
Hidalgo	78,926	79,142	79,380	79,637	80,018 (16,004) [3,841] {1,920}	80,364 (16,073) [3,857] {1,929}	80,707 (16,141) [3,874] {1,937}
Johnson	18,798	18,810	18,841	18,870	18,918 (3,784) [908] {454}	18,962 (3,792) [910] {455}	19,004 (3,801) [912] {456}
Lubbock	48,260	48,272	48,285	48,301	48,323 (9,665) [2,320] {1,160}	48,343 (9,669) [2,320] {1,160}	48,361 (9,672) [2,321] {1,161}
McLennan	25,370	25,387	25,428	25,455	25,512 (5,102) [1,225] {612}	25,564 (5,113) [1,227] {614}	25,611 (5,122) [1,229] {615}
Montgomery	46,534	46,713	46,794	46,993	47,291 (9,458) [2,270] {1,135}	47,589 (9,518) [2,284] {1,142}	47,880 (9,576) [2,298] {1,149}
Tarrant	245,385	245,629	246,077	246,510	247,215 (49,443) [11,866] {5,933}	247,892 (49,578) [11,899] {5,949}	248,550 (49,710) [11,930] {5,965}
Travis	76,742	76,855	77,082	77,231	77,487 (15,497) [3,719] {1,860}	77,734 (15,547) [3,731] {1,866}	77,974 (15,595) [3,743] {1,871}
Williamson	41,498	41,588	41,649	41,799	41,950 (8,390) [2,014] {1,007}	42,096 (8,419) [2,021] {1,010}	42,238 (8,448) [2,027] {1,014}

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.