IEM's AI Modeling: Short-term COVID-19 Projections
Date: 3/11/21

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 3/11/21 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
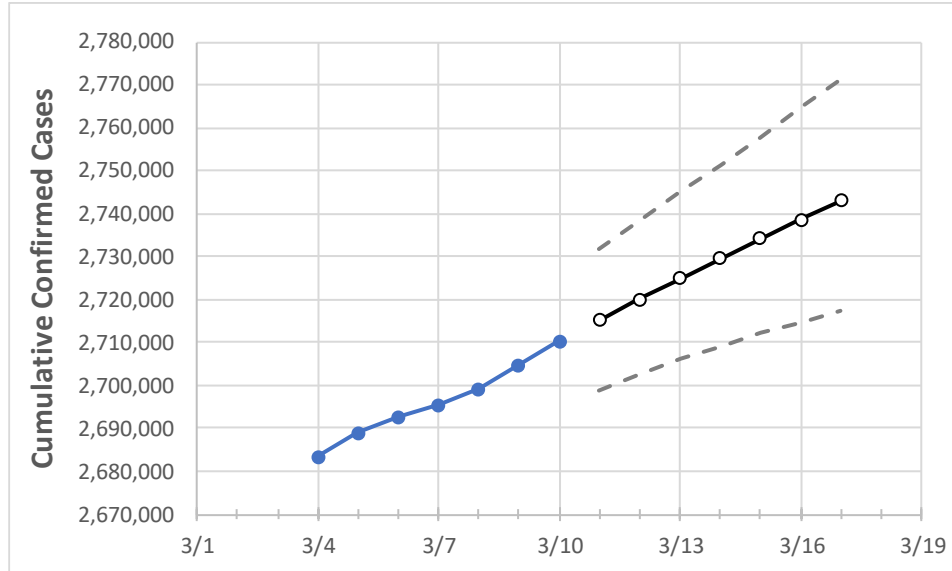
	Actual Confirmed Cases On:				Projected Cases For:						
	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16	3/17
Texas	2,695,558	2,699,083	2,704,712	2,710,278	2,715,251	2,720,120	2,724,961	2,729,621	2,734,173	2,738,598	2,742,987

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:						
	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14	3/15	3/16	3/17
Bexar	198,568	198,798	198,969	199,065	199,292	199,484	199,671	199,846	200,024	200,188	200,332
Brazoria	33,669	33,698	33,839	33,943	34,048	34,148	34,252	34,353	34,453	34,554	34,656
Brazos	21,508	21,531	21,587	21,701	21,770	21,836	21,903	21,972	22,041	22,108	22,174
Collin	83,990	84,151	84,309	84,589	84,711	84,827	84,935	85,039	85,140	85,235	85,328
Dallas	284,318	284,627	284,935	285,332	285,764	286,197	286,615	287,029	287,437	287,836	288,222
Denton	67,467	67,776	68,236	68,852	69,338	69,834	70,335	70,844	71,357	71,882	72,405
El Paso	125,372	125,542	125,830	125,985	126,187	126,382	126,573	126,758	126,942	127,122	127,298
Ellis	21,389	21,398	21,407	21,437	21,503	21,570	21,637	21,704	21,772	21,840	21,911
Fort Bend	59,373	59,414	59,821	60,499	60,752	61,017	61,278	61,544	61,819	62,097	62,377
Galveston	35,354	35,408	35,461	35,597	35,707	35,815	35,923	36,028	36,131	36,239	36,344
Harris	359,382	359,948	360,421	360,938	361,924	362,918	363,963	365,022	366,005	367,010	367,988
Hidalgo	78,874	78,926	79,142	79,380	79,598	79,810	80,015	80,202	80,382	80,563	80,740
Johnson	18,787	18,798	18,810	18,841	18,866	18,890	18,913	18,935	18,957	18,977	18,996
Lubbock	48,249	48,260	48,272	48,285	48,298	48,310	48,321	48,331	48,341	48,350	48,359
McLennan	25,352	25,370	25,387	25,428	25,459	25,489	25,518	25,545	25,572	25,596	25,621
Montgomery	46,389	46,534	46,713	46,794	46,940	47,087	47,234	47,381	47,530	47,673	47,817
Tarrant	244,957	245,385	245,629	246,077	246,458	246,837	247,199	247,561	247,908	248,237	248,567
Travis	76,638	76,742	76,855	77,082	77,214	77,343	77,471	77,593	77,708	77,825	77,941
Williamson	41,449	41,498	41,588	41,649	41,717	41,783	41,849	41,911	41,974	42,033	42,091

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:		
	3/7	3/8	3/9	3/10	3/12	3/14	3/16
Bexar	198,568	198,798	198,969	199,065	199,484 (39,897) [9,575] {4,788}	199,846 (39,969) [9,593] {4,796}	200,188 (40,038) [9,609] {4,805}
Brazoria	33,669	33,698	33,839	33,943	34,148 (6,830) [1,639] {820}	34,353 (6,871) [1,649] {824}	34,554 (6,911) [1,659] {829}
Brazos	21,508	21,531	21,587	21,701	21,836 (4,367) [1,048] {524}	21,972 (4,394) [1,055] {527}	22,108 (4,422) [1,061] {531}
Collin	83,990	84,151	84,309	84,589	84,827 (16,965) [4,072] {2,036}	85,039 (17,008) [4,082] {2,041}	85,235 (17,047) [4,091] {2,046}
Dallas	284,318	284,627	284,935	285,332	286,197 (57,239) [13,737] {6,869}	287,029 (57,406) [13,777] {6,889}	287,836 (57,567) [13,816] {6,908}
Denton	67,467	67,776	68,236	68,852	69,834 (13,967) [3,352] {1,676}	70,844 (14,169) [3,400] {1,700}	71,882 (14,376) [3,450] {1,725}
El Paso	125,372	125,542	125,830	125,985	126,382 (25,276) [6,066] {3,033}	126,758 (25,352) [6,084] {3,042}	127,122 (25,424) [6,102] {3,051}
Ellis	21,389	21,398	21,407	21,437	21,570 (4,314) [1,035] {518}	21,704 (4,341) [1,042] {521}	21,840 (4,368) [1,048] {524}
Fort Bend	59,373	59,414	59,821	60,499	61,017 (12,203) [2,929] {1,464}	61,544 (12,309) [2,954] {1,477}	62,097 (12,419) [2,981] {1,490}
Galveston	35,354	35,408	35,461	35,597	35,815 (7,163) [1,719] {860}	36,028 (7,206) [1,729] {865}	36,239 (7,248) [1,739] {870}
Harris	359,382	359,948	360,421	360,938	362,918 (72,584) [17,420] {8,710}	365,022 (73,004) [17,521] {8,761}	367,010 (73,402) [17,616] {8,808}
Hidalgo	78,874	78,926	79,142	79,380	79,810 (15,962) [3,831] {1,915}	80,202 (16,040) [3,850] {1,925}	80,563 (16,113) [3,867] {1,934}
Johnson	18,787	18,798	18,810	18,841	18,890 (3,778) [907] {453}	18,935 (3,787) [909] {454}	18,977 (3,795) [911] {455}
Lubbock	48,249	48,260	48,272	48,285	48,310 (9,662) [2,319] {1,159}	48,331 (9,666) [2,320] {1,160}	48,350 (9,670) [2,321] {1,160}
McLennan	25,352	25,370	25,387	25,428	25,489 (5,098) [1,223] {612}	25,545 (5,109) [1,226] {613}	25,596 (5,119) [1,229] {614}
Montgomery	46,389	46,534	46,713	46,794	47,087 (9,417) [2,260] {1,130}	47,381 (9,476) [2,274] {1,137}	47,673 (9,535) [2,288] {1,144}
Tarrant	244,957	245,385	245,629	246,077	246,837 (49,367) [11,848] {5,924}	247,561 (49,512) [11,883] {5,941}	248,237 (49,647) [11,915] {5,958}
Travis	76,638	76,742	76,855	77,082	77,343 (15,469) [3,712] {1,856}	77,593 (15,519) [3,724] {1,862}	77,825 (15,565) [3,736] {1,868}
Williamson	41,449	41,498	41,588	41,649	41,783 (8,357) [2,006] {1,003}	41,911 (8,382) [2,012] {1,006}	42,033 (8,407) [2,018] {1,009}

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.