IEM's AI Modeling: Short-term COVID-19 Projections
Date: 3/16/21

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 3/16/21 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
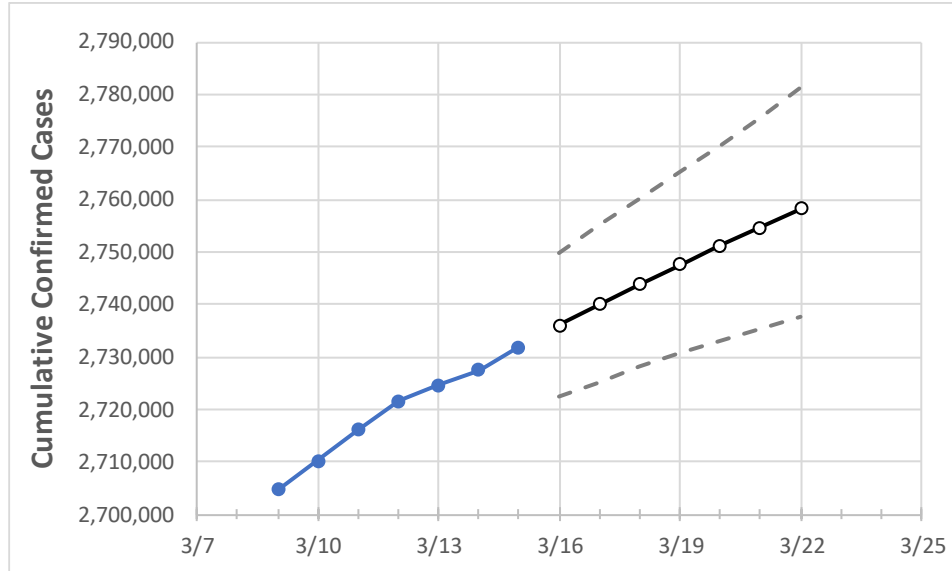
	Actual Confirmed Cases On:				Projected Cases For:						
	3/12	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22
Texas	2,721,511	2,724,607	2,727,462	2,731,814	2,735,934	2,739,964	2,743,858	2,747,600	2,751,279	2,754,698	2,758,217

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:						
	3/12	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22
Bexar	199,431	199,673	200,664	200,818	201,050	201,269	201,508	201,733	201,934	202,135	202,322
Brazoria	34,102	34,221	34,301	34,373	34,464	34,548	34,636	34,726	34,811	34,897	34,983
Brazos	21,948	21,988	22,028	22,068	22,137	22,209	22,279	22,349	22,420	22,493	22,560
Collin	84,844	84,925	84,964	85,182	85,287	85,387	85,490	85,583	85,679	85,770	85,856
Dallas	286,084	286,351	286,638	286,925	287,268	287,594	287,920	288,243	288,555	288,870	289,164
Denton	69,633	69,698	69,852	70,006	70,363	70,712	71,065	71,417	71,763	72,091	72,428
El Paso	126,416	126,641	126,796	126,981	127,156	127,331	127,502	127,672	127,835	127,999	128,157
Ellis	21,523	21,541	21,541	21,541	21,593	21,644	21,695	21,746	21,796	21,845	21,897
Fort Bend	60,797	60,855	60,913	60,971	61,161	61,349	61,537	61,722	61,914	62,089	62,264
Galveston	35,770	35,860	35,983	35,983	36,082	36,180	36,276	36,369	36,461	36,554	36,645
Harris	363,548	364,613	365,338	365,513	366,433	367,326	368,221	369,123	370,016	370,901	371,733
Hidalgo	80,455	80,719	80,984	81,248	81,515	81,781	82,038	82,300	82,553	82,818	83,067
Johnson	18,911	18,920	18,920	18,920	18,941	18,962	18,982	19,002	19,021	19,040	19,058
Lubbock	48,319	48,347	48,347	48,347	48,359	48,371	48,383	48,394	48,405	48,416	48,426
McLennan	25,493	25,521	25,521	25,521	25,547	25,572	25,595	25,619	25,642	25,663	25,684
Montgomery	47,171	47,273	47,376	47,478	47,611	47,745	47,876	48,003	48,132	48,266	48,397
Tarrant	246,833	246,985	247,136	247,549	247,827	248,101	248,362	248,621	248,871	249,112	249,348
Travis	77,329	77,408	77,485	77,669	77,781	77,892	78,001	78,102	78,210	78,316	78,418
Williamson	41,879	41,941	42,004	42,066	42,133	42,200	42,264	42,329	42,393	42,453	42,512

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:		
	3/12	3/13	3/14	3/15	3/17	3/19	3/21
Bexar	199,431	199,673	200,664	200,818	201,269 (40,254) [9,661] {4,830}	201,733 (40,347) [9,683] {4,842}	202,135 (40,427) [9,702] {4,851}
Brazoria	34,102	34,221	34,301	34,373	34,548 (6,910) [1,658] {829}	34,726 (6,945) [1,667] {833}	34,897 (6,979) [1,675] {838}
Brazos	21,948	21,988	22,028	22,068	22,209 (4,442) [1,066] {533}	22,349 (4,470) [1,073] {536}	22,493 (4,499) [1,080] {540}
Collin	84,844	84,925	84,964	85,182	85,387 (17,077) [4,099] {2,049}	85,583 (17,117) [4,108] {2,054}	85,770 (17,154) [4,117] {2,058}
Dallas	286,084	286,351	286,638	286,925	287,594 (57,519) [13,805] {6,902}	288,243 (57,649) [13,836] {6,918}	288,870 (57,774) [13,866] {6,933}
Denton	69,633	69,698	69,852	70,006	70,712 (14,142) [3,394] {1,697}	71,417 (14,283) [3,428] {1,714}	72,091 (14,418) [3,460] {1,730}
El Paso	126,416	126,641	126,796	126,981	127,331 (25,466) [6,112] {3,056}	127,672 (25,534) [6,128] {3,064}	127,999 (25,600) [6,144] {3,072}
Ellis	21,523	21,541	21,541	21,541	21,644 (4,329) [1,039] {519}	21,746 (4,349) [1,044] {522}	21,845 (4,369) [1,049] {524}
Fort Bend	60,797	60,855	60,913	60,971	61,349 (12,270) [2,945] {1,472}	61,722 (12,344) [2,963] {1,481}	62,089 (12,418) [2,980] {1,490}
Galveston	35,770	35,860	35,983	35,983	36,180 (7,236) [1,737] {868}	36,369 (7,274) [1,746] {873}	36,554 (7,311) [1,755] {877}
Harris	363,548	364,613	365,338	365,513	367,326 (73,465) [17,632] {8,816}	369,123 (73,825) [17,718] {8,859}	370,901 (74,180) [17,803] {8,902}
Hidalgo	80,455	80,719	80,984	81,248	81,781 (16,356) [3,926] {1,963}	82,300 (16,460) [3,950] {1,975}	82,818 (16,564) [3,975] {1,988}
Johnson	18,911	18,920	18,920	18,920	18,962 (3,792) [910] {455}	19,002 (3,800) [912] {456}	19,040 (3,808) [914] {457}
Lubbock	48,319	48,347	48,347	48,347	48,371 (9,674) [2,322] {1,161}	48,394 (9,679) [2,323] {1,161}	48,416 (9,683) [2,324] {1,162}
McLennan	25,493	25,521	25,521	25,521	25,572 (5,114) [1,227] {614}	25,619 (5,124) [1,230] {615}	25,663 (5,133) [1,232] {616}
Montgomery	47,171	47,273	47,376	47,478	47,745 (9,549) [2,292] {1,146}	48,003 (9,601) [2,304] {1,152}	48,266 (9,653) [2,317] {1,158}
Tarrant	246,833	246,985	247,136	247,549	248,101 (49,620) [11,909] {5,954}	248,621 (49,724) [11,934] {5,967}	249,112 (49,822) [11,957] {5,979}
Travis	77,329	77,408	77,485	77,669	77,892 (15,578) [3,739] {1,869}	78,102 (15,620) [3,749] {1,874}	78,316 (15,663) [3,759] {1,880}
Williamson	41,879	41,941	42,004	42,066	42,200 (8,440) [2,026] {1,013}	42,329 (8,466) [2,032] {1,016}	42,453 (8,491) [2,038] {1,019}

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.