IEM's AI Modeling: Short-term COVID-19 Projections
Date: 3/26/21

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 3/26/21 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
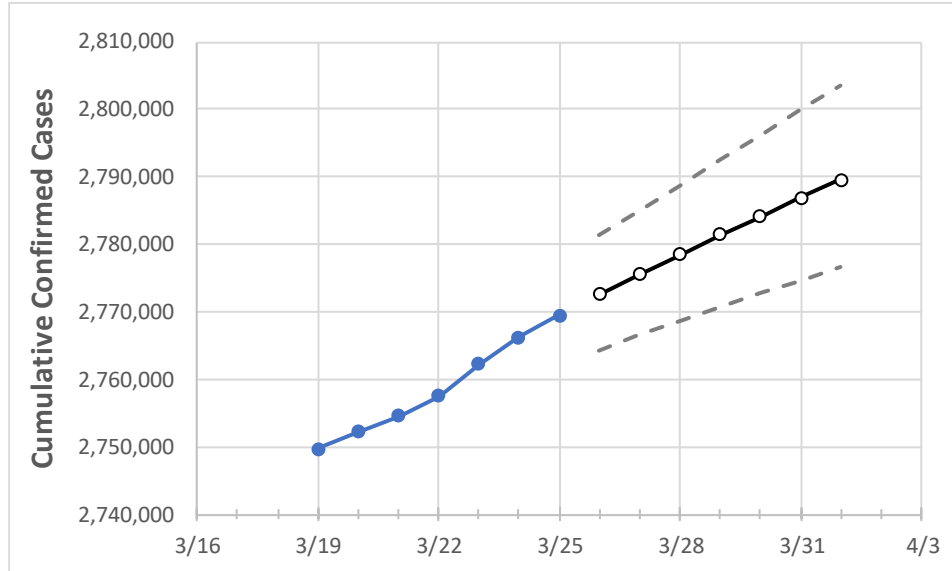
	Actual Confirmed Cases On:				Projected Cases For:						
	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	3/31	4/1
Texas	2,757,552	2,762,270	2,766,259	2,769,451	2,772,579	2,775,592	2,778,525	2,781,384	2,784,131	2,786,902	2,789,612

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:						
	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29	3/30	3/31	4/1
Bexar	202,716	202,849	202,981	203,191	203,419	203,639	203,857	204,068	204,280	204,485	204,692
Brazoria	34,891	34,979	35,039	35,107	35,173	35,236	35,299	35,362	35,425	35,486	35,546
Brazos	22,538	22,582	22,739	22,836	22,907	22,980	23,053	23,125	23,196	23,267	23,341
Collin	85,702	85,885	85,816	85,893	85,965	86,038	86,109	86,174	86,237	86,299	86,359
Dallas	288,700	288,928	289,198	289,494	289,709	289,918	290,121	290,321	290,512	290,702	290,888
Denton	71,071	71,200	71,314	71,388	71,481	71,569	71,651	71,729	71,799	71,864	71,923
El Paso	128,119	128,252	128,435	128,615	128,759	128,901	129,041	129,176	129,310	129,440	129,570
Ellis	21,677	21,691	21,721	21,729	21,739	21,750	21,759	21,767	21,775	21,782	21,789
Fort Bend	62,025	62,354	62,587	62,675	62,808	62,942	63,073	63,207	63,326	63,449	63,579
Galveston	36,512	36,559	36,629	36,708	36,768	36,826	36,882	36,936	36,991	37,042	37,093
Harris	370,459	371,161	371,494	372,071	372,600	373,114	373,595	374,066	374,499	374,950	375,376
Hidalgo	83,531	83,714	84,085	84,281	84,552	84,812	85,081	85,330	85,573	85,815	86,044
Johnson	19,108	19,123	19,155	19,186	19,204	19,223	19,240	19,258	19,275	19,293	19,310
Lubbock	48,449	48,457	48,458	48,470	48,479	48,488	48,496	48,505	48,512	48,520	48,528
McLennan	25,813	25,846	25,885	25,920	25,952	25,985	26,017	26,048	26,080	26,112	26,143
Montgomery	48,355	48,506	48,713	48,832	48,961	49,089	49,217	49,342	49,466	49,587	49,713
Tarrant	249,150	249,418	249,679	249,821	249,998	250,177	250,343	250,504	250,663	250,817	250,960
Travis	78,308	78,372	78,496	78,602	78,694	78,783	78,871	78,962	79,047	79,133	79,218
Williamson	42,473	42,627	42,693	42,775	42,842	42,909	42,977	43,043	43,108	43,174	43,241

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:		
	3/22	3/23	3/24	3/25	3/27	3/29	3/31
Bexar	202,716	202,849	202,981	203,191	203,639 (40,728) [9,775] {4,887}	204,068 (40,814) [9,795] {4,898}	204,485 (40,897) [9,815] {4,908}
Brazoria	34,891	34,979	35,039	35,107	35,236 (7,047) [1,691] {846}	35,362 (7,072) [1,697] {849}	35,486 (7,097) [1,703] {852}
Brazos	22,538	22,582	22,739	22,836	22,980 (4,596) [1,103] {552}	23,125 (4,625) [1,110] {555}	23,267 (4,653) [1,117] {558}
Collin	85,702	85,885	85,816	85,893	86,038 (17,208) [4,130] {2,065}	86,174 (17,235) [4,136] {2,068}	86,299 (17,260) [4,142] {2,071}
Dallas	288,700	288,928	289,198	289,494	289,918 (57,984) [13,916] {6,958}	290,321 (58,064) [13,935] {6,968}	290,702 (58,140) [13,954] {6,977}
Denton	71,071	71,200	71,314	71,388	71,569 (14,314) [3,435] {1,718}	71,729 (14,346) [3,443] {1,722}	71,864 (14,373) [3,449] {1,725}
El Paso	128,119	128,252	128,435	128,615	128,901 (25,780) [6,187] {3,094}	129,176 (25,835) [6,200] {3,100}	129,440 (25,888) [6,213] {3,107}
Ellis	21,677	21,691	21,721	21,729	21,750 (4,350) [1,044] {522}	21,767 (4,353) [1,045] {522}	21,782 (4,356) [1,046] {523}
Fort Bend	62,025	62,354	62,587	62,675	62,942 (12,588) [3,021] {1,511}	63,207 (12,641) [3,034] {1,517}	63,449 (12,690) [3,046] {1,523}
Galveston	36,512	36,559	36,629	36,708	36,826 (7,365) [1,768] {884}	36,936 (7,387) [1,773] {886}	37,042 (7,408) [1,778] {889}
Harris	370,459	371,161	371,494	372,071	373,114 (74,623) [17,909] {8,955}	374,066 (74,813) [17,955] {8,978}	374,950 (74,990) [17,998] {8,999}
Hidalgo	83,531	83,714	84,085	84,281	84,812 (16,962) [4,071] {2,035}	85,330 (17,066) [4,096] {2,048}	85,815 (17,163) [4,119] {2,060}
Johnson	19,108	19,123	19,155	19,186	19,223 (3,845) [923] {461}	19,258 (3,852) [924] {462}	19,293 (3,859) [926] {463}
Lubbock	48,449	48,457	48,458	48,470	48,488 (9,698) [2,327] {1,164}	48,505 (9,701) [2,328] {1,164}	48,520 (9,704) [2,329] {1,164}
McLennan	25,813	25,846	25,885	25,920	25,985 (5,197) [1,247] {624}	26,048 (5,210) [1,250] {625}	26,112 (5,222) [1,253] {627}
Montgomery	48,355	48,506	48,713	48,832	49,089 (9,818) [2,356] {1,178}	49,342 (9,868) [2,368] {1,184}	49,587 (9,917) [2,380] {1,190}
Tarrant	249,150	249,418	249,679	249,821	250,177 (50,035) [12,008] {6,004}	250,504 (50,101) [12,024] {6,012}	250,817 (50,163) [12,039] {6,020}
Travis	78,308	78,372	78,496	78,602	78,783 (15,757) [3,782] {1,891}	78,962 (15,792) [3,790] {1,895}	79,133 (15,827) [3,798] {1,899}
Williamson	42,473	42,627	42,693	42,775	42,909 (8,582) [2,060] {1,030}	43,043 (8,609) [2,066] {1,033}	43,174 (8,635) [2,072] {1,036}

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.