IEM's AI Modeling: Short-term COVID-19 Projections
Date: 3/17/21

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 3/17/21 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
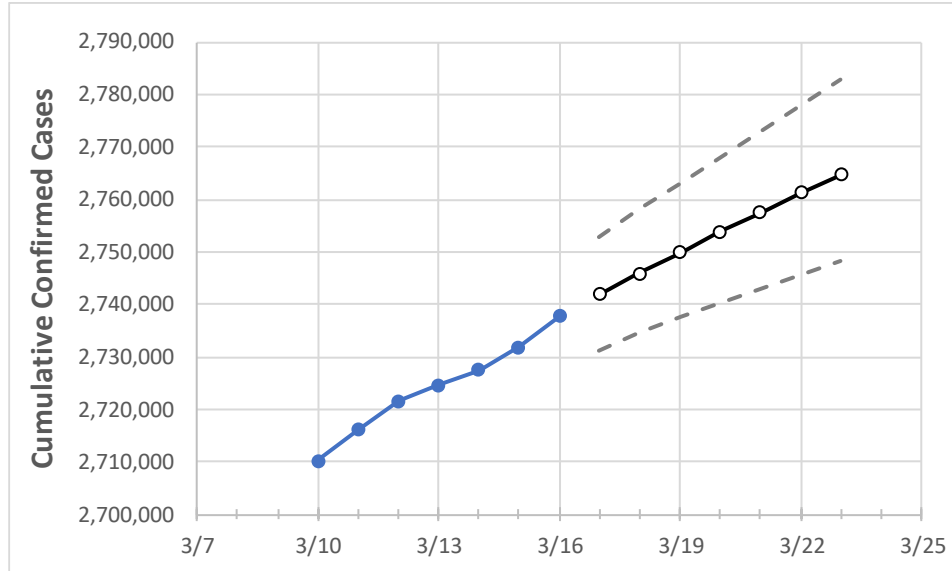
	Actual Confirmed Cases On:				Projected Cases For:						
	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23
Texas	2,724,607	2,727,462	2,731,814	2,737,763	2,741,896	2,745,983	2,749,945	2,753,817	2,757,568	2,761,191	2,764,717

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:						
	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21	3/22	3/23
Bexar	199,673	200,664	200,818	201,010	201,239	201,456	201,675	201,883	202,081	202,280	202,486
Brazoria	34,221	34,301	34,373	34,426	34,516	34,597	34,681	34,766	34,845	34,930	35,007
Brazos	21,988	22,028	22,068	22,145	22,213	22,283	22,349	22,420	22,487	22,557	22,625
Collin	84,925	84,964	85,182	85,315	85,416	85,518	85,612	85,706	85,802	85,892	85,981
Dallas	286,351	286,638	286,925	287,236	287,544	287,850	288,138	288,419	288,684	288,941	289,194
Denton	69,698	69,852	70,006	70,343	70,659	70,968	71,279	71,586	71,891	72,187	72,471
El Paso	126,641	126,796	126,981	127,168	127,347	127,521	127,686	127,855	128,013	128,173	128,329
Ellis	21,541	21,556	21,572	21,587	21,629	21,671	21,710	21,749	21,787	21,825	21,862
Fort Bend	60,855	60,913	60,971	61,286	61,479	61,669	61,858	62,056	62,244	62,436	62,618
Galveston	35,860	35,983	36,047	36,111	36,197	36,281	36,363	36,446	36,529	36,611	36,693
Harris	364,613	365,338	365,513	366,966	367,843	368,705	369,569	370,416	371,261	372,093	372,924
Hidalgo	80,719	80,984	81,248	82,222	82,570	82,926	83,273	83,618	83,957	84,305	84,661
Johnson	18,920	18,936	18,953	18,969	18,988	19,007	19,024	19,041	19,058	19,074	19,088
Lubbock	48,347	48,362	48,377	48,392	48,404	48,415	48,427	48,438	48,449	48,458	48,469
McLennan	25,521	25,545	25,568	25,592	25,616	25,640	25,662	25,684	25,705	25,724	25,744
Montgomery	47,273	47,376	47,478	47,595	47,728	47,858	47,984	48,115	48,243	48,370	48,495
Tarrant	246,985	247,136	247,549	247,779	248,055	248,313	248,562	248,808	249,047	249,280	249,504
Travis	77,408	77,485	77,669	77,775	77,887	77,995	78,103	78,208	78,310	78,411	78,513
Williamson	41,941	42,004	42,066	42,143	42,207	42,269	42,329	42,391	42,451	42,511	42,568

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:		
	3/13	3/14	3/15	3/16	3/18	3/20	3/22
Bexar	199,673	200,664	200,818	201,010	201,456 (40,291) [9,670] {4,835}	201,883 (40,377) [9,690] {4,845}	202,280 (40,456) [9,709] {4,855}
Brazoria	34,221	34,301	34,373	34,426	34,597 (6,919) [1,661] {830}	34,766 (6,953) [1,669] {834}	34,930 (6,986) [1,677] {838}
Brazos	21,988	22,028	22,068	22,145	22,283 (4,457) [1,070] {535}	22,420 (4,484) [1,076] {538}	22,557 (4,511) [1,083] {541}
Collin	84,925	84,964	85,182	85,315	85,518 (17,104) [4,105] {2,052}	85,706 (17,141) [4,114] {2,057}	85,892 (17,178) [4,123] {2,061}
Dallas	286,351	286,638	286,925	287,236	287,850 (57,570) [13,817] {6,908}	288,419 (57,684) [13,844] {6,922}	288,941 (57,788) [13,869] {6,935}
Denton	69,698	69,852	70,006	70,343	70,968 (14,194) [3,406] {1,703}	71,586 (14,317) [3,436] {1,718}	72,187 (14,437) [3,465] {1,732}
El Paso	126,641	126,796	126,981	127,168	127,521 (25,504) [6,121] {3,061}	127,855 (25,571) [6,137] {3,069}	128,173 (25,635) [6,152] {3,076}
Ellis	21,541	21,556	21,572	21,587	21,671 (4,334) [1,040] {520}	21,749 (4,350) [1,044] {522}	21,825 (4,365) [1,048] {524}
Fort Bend	60,855	60,913	60,971	61,286	61,669 (12,334) [2,960] {1,480}	62,056 (12,411) [2,979] {1,489}	62,436 (12,487) [2,997] {1,498}
Galveston	35,860	35,983	36,047	36,111	36,281 (7,256) [1,742] {871}	36,446 (7,289) [1,749] {875}	36,611 (7,322) [1,757] {879}
Harris	364,613	365,338	365,513	366,966	368,705 (73,741) [17,698] {8,849}	370,416 (74,083) [17,780] {8,890}	372,093 (74,419) [17,860] {8,930}
Hidalgo	80,719	80,984	81,248	82,222	82,926 (16,585) [3,980] {1,990}	83,618 (16,724) [4,014] {2,007}	84,305 (16,861) [4,047] {2,023}
Johnson	18,920	18,936	18,953	18,969	19,007 (3,801) [912] {456}	19,041 (3,808) [914] {457}	19,074 (3,815) [916] {458}
Lubbock	48,347	48,362	48,377	48,392	48,415 (9,683) [2,324] {1,162}	48,438 (9,688) [2,325] {1,163}	48,458 (9,692) [2,326] {1,163}
McLennan	25,521	25,545	25,568	25,592	25,640 (5,128) [1,231] {615}	25,684 (5,137) [1,233] {616}	25,724 (5,145) [1,235] {617}
Montgomery	47,273	47,376	47,478	47,595	47,858 (9,572) [2,297] {1,149}	48,115 (9,623) [2,310] {1,155}	48,370 (9,674) [2,322] {1,161}
Tarrant	246,985	247,136	247,549	247,779	248,313 (49,663) [11,919] {5,960}	248,808 (49,762) [11,943] {5,971}	249,280 (49,856) [11,965] {5,983}
Travis	77,408	77,485	77,669	77,775	77,995 (15,599) [3,744] {1,872}	78,208 (15,642) [3,754] {1,877}	78,411 (15,682) [3,764] {1,882}
Williamson	41,941	42,004	42,066	42,143	42,269 (8,454) [2,029] {1,014}	42,391 (8,478) [2,035] {1,017}	42,511 (8,502) [2,041] {1,020}

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.