IEM's AI Modeling: Short-term COVID-19 Projections
Date: 3/4/22

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 3/4/22 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
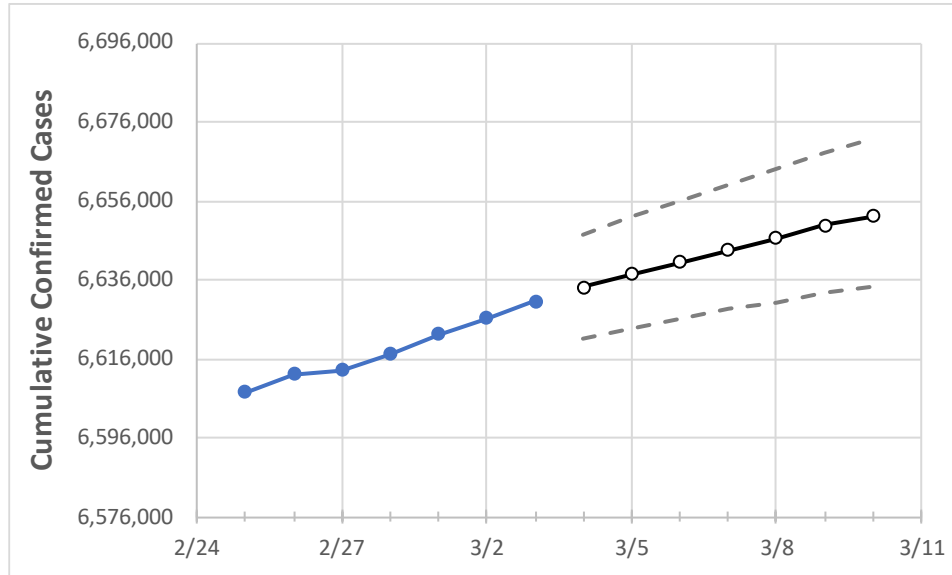
	Actual Confirmed Cases On:				Projected Cases For:						
	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10
Texas	6,617,106	6,622,301	6,626,391	6,630,636	6,634,037	6,637,446	6,640,580	6,643,465	6,646,496	6,649,784	6,652,107

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:						
	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10
Bexar	544,092	544,603	544,972	545,328	545,640	545,941	546,222	546,482	546,764	547,007	547,227
Brazoria	92,654	92,688	92,705	92,721	92,750	92,776	92,798	92,819	92,841	92,862	92,880
Brazos	59,637	59,648	59,667	59,692	59,707	59,721	59,735	59,749	59,760	59,772	59,783
Collin	203,198	203,459	203,709	203,879	203,999	204,120	204,214	204,321	204,428	204,513	204,612
Dallas	565,280	565,424	565,498	565,596	565,773	565,941	566,093	566,238	566,400	566,530	566,663
Denton	176,162	176,306	176,451	176,606	176,702	176,787	176,877	176,954	177,035	177,104	177,168
El Paso	203,237	203,328	203,350	203,428	203,496	203,552	203,611	203,659	203,712	203,763	203,811
Ellis	48,231	48,265	48,304	48,343	48,375	48,406	48,433	48,462	48,490	48,521	48,546
Fort Bend	176,429	176,675	176,826	177,025	177,177	177,351	177,495	177,659	177,801	177,952	178,095
Galveston	94,627	94,650	94,667	94,696	94,718	94,739	94,756	94,776	94,791	94,806	94,820
Harris	992,400	992,769	992,979	993,328	993,779	994,128	994,504	994,829	995,192	995,517	995,713
Hidalgo	192,771	193,318	193,656	194,128	194,424	194,712	194,983	195,247	195,511	195,788	196,009
Johnson	41,646	41,675	41,699	41,743	41,757	41,773	41,787	41,799	41,812	41,826	41,839
Lubbock	92,966	92,983	93,010	93,020	93,034	93,045	93,057	93,067	93,078	93,088	93,098
McLennan	56,267	56,314	56,409	56,462	56,505	56,549	56,583	56,625	56,662	56,697	56,731
Montgomery	135,287	135,370	135,419	135,467	135,533	135,592	135,650	135,706	135,758	135,812	135,859
Tarrant	557,808	558,216	558,677	558,955	559,152	559,370	559,544	559,727	559,878	560,035	560,226
Travis	218,804	218,929	218,994	219,076	219,150	219,222	219,289	219,354	219,414	219,473	219,531
Williamson	131,056	131,128	131,193	131,270	131,320	131,373	131,420	131,464	131,509	131,551	131,588

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:		
	2/28	3/1	3/2	3/3	3/5	3/7	3/9
Bexar	544,092	544,603	544,972	545,328	545,941 (109,188) [26,205] {13,103}	546,482 (109,296) [26,231] {13,116}	547,007 (109,401) [26,256] {13,128}
Brazoria	92,654	92,688	92,705	92,721	92,776 (18,555) [4,453] {2,227}	92,819 (18,564) [4,455] {2,228}	92,862 (18,572) [4,457] {2,229}
Brazos	59,637	59,648	59,667	59,692	59,721 (11,944) [2,867] {1,433}	59,749 (11,950) [2,868] {1,434}	59,772 (11,954) [2,869] {1,435}
Collin	203,198	203,459	203,709	203,879	204,120 (40,824) [9,798] {4,899}	204,321 (40,864) [9,807] {4,904}	204,513 (40,903) [9,817] {4,908}
Dallas	565,280	565,424	565,498	565,596	565,941 (113,188) [27,165] {13,583}	566,238 (113,248) [27,179] {13,590}	566,530 (113,306) [27,193] {13,597}
Denton	176,162	176,306	176,451	176,606	176,787 (35,357) [8,486] {4,243}	176,954 (35,391) [8,494] {4,247}	177,104 (35,421) [8,501] {4,251}
El Paso	203,237	203,328	203,350	203,428	203,552 (40,710) [9,770] {4,885}	203,659 (40,732) [9,776] {4,888}	203,763 (40,753) [9,781] {4,890}
Ellis	48,231	48,265	48,304	48,343	48,406 (9,681) [2,323] {1,162}	48,462 (9,692) [2,326] {1,163}	48,521 (9,704) [2,329] {1,165}
Fort Bend	176,429	176,675	176,826	177,025	177,351 (35,470) [8,513] {4,256}	177,659 (35,532) [8,528] {4,264}	177,952 (35,590) [8,542] {4,271}
Galveston	94,627	94,650	94,667	94,696	94,739 (18,948) [4,547] {2,274}	94,776 (18,955) [4,549] {2,275}	94,806 (18,961) [4,551] {2,275}
Harris	992,400	992,769	992,979	993,328	994,128 (198,826) [47,718] {23,859}	994,829 (198,966) [47,752] {23,876}	995,517 (199,103) [47,785] {23,892}
Hidalgo	192,771	193,318	193,656	194,128	194,712 (38,942) [9,346] {4,673}	195,247 (39,049) [9,372] {4,686}	195,788 (39,158) [9,398] {4,699}
Johnson	41,646	41,675	41,699	41,743	41,773 (8,355) [2,005] {1,003}	41,799 (8,360) [2,006] {1,003}	41,826 (8,365) [2,008] {1,004}
Lubbock	92,966	92,983	93,010	93,020	93,045 (18,609) [4,466] {2,233}	93,067 (18,613) [4,467] {2,234}	93,088 (18,618) [4,468] {2,234}
McLennan	56,267	56,314	56,409	56,462	56,549 (11,310) [2,714] {1,357}	56,625 (11,325) [2,718] {1,359}	56,697 (11,339) [2,721] {1,361}
Montgomery	135,287	135,370	135,419	135,467	135,592 (27,118) [6,508] {3,254}	135,706 (27,141) [6,514] {3,257}	135,812 (27,162) [6,519] {3,259}
Tarrant	557,808	558,216	558,677	558,955	559,370 (111,874) [26,850] {13,425}	559,727 (111,945) [26,867] {13,433}	560,035 (112,007) [26,882] {13,441}
Travis	218,804	218,929	218,994	219,076	219,222 (43,844) [10,523] {5,261}	219,354 (43,871) [10,529] {5,264}	219,473 (43,895) [10,535] {5,267}
Williamson	131,056	131,128	131,193	131,270	131,373 (26,275) [6,306] {3,153}	131,464 (26,293) [6,310] {3,155}	131,551 (26,310) [6,314] {3,157}

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.