IEM's AI Modeling: Short-term COVID-19 Projections
Date: 12/10/21

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 12/10/21 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
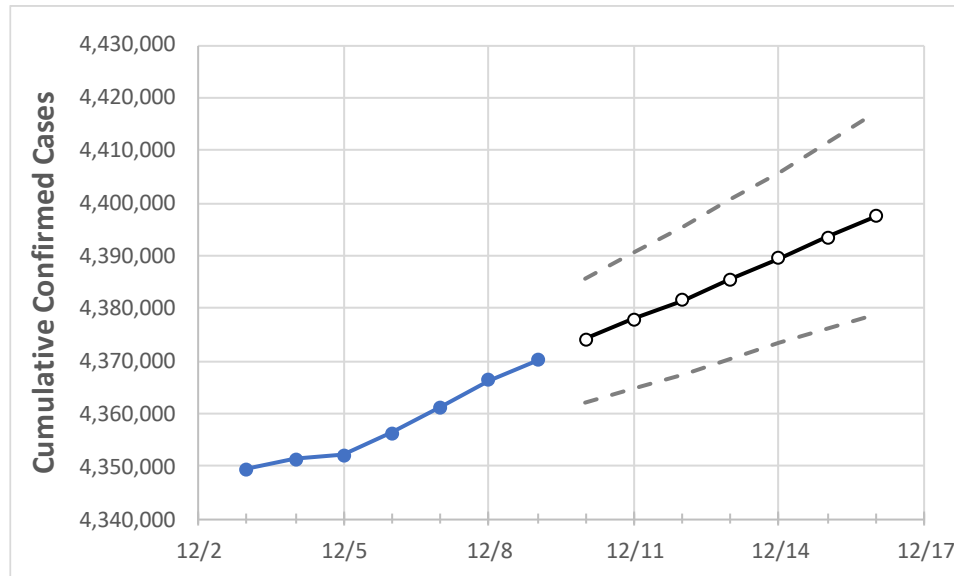
	Actual Confirmed Cases On:				Projected Cases For:						
	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14	12/15	12/16
Texas	4,356,275	4,361,295	4,366,341	4,370,210	4,374,028	4,377,849	4,381,502	4,385,582	4,389,462	4,393,555	4,397,449

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:						
	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14	12/15	12/16
Bexar	329,124	329,478	329,711	329,978	330,258	330,546	330,834	331,132	331,440	331,744	332,062
Brazoria	61,022	61,050	61,071	61,099	61,122	61,144	61,167	61,189	61,211	61,233	61,255
Brazos	39,194	39,222	39,249	39,274	39,293	39,313	39,331	39,350	39,371	39,390	39,410
Collin	133,653	133,779	133,834	133,928	134,046	134,164	134,284	134,406	134,523	134,654	134,769
Dallas	415,315	415,687	416,696	417,081	417,421	417,742	418,046	418,374	418,726	419,065	419,393
Denton	111,758	111,961	112,171	112,396	112,526	112,656	112,784	112,918	113,065	113,204	113,338
El Paso	161,605	161,891	162,046	162,139	162,437	162,727	163,010	163,299	163,575	163,859	164,142
Ellis	34,173	34,199	34,221	34,233	34,244	34,258	34,270	34,281	34,294	34,308	34,321
Fort Bend	103,117	103,408	103,516	103,600	103,752	103,876	104,030	104,158	104,292	104,489	104,639
Galveston	65,405	65,437	65,450	65,463	65,484	65,502	65,518	65,535	65,552	65,570	65,585
Harris	588,100	588,580	589,253	589,735	590,105	590,497	590,859	591,269	591,628	592,054	592,423
Hidalgo	120,274	120,542	120,542	120,542	120,744	120,948	121,166	121,393	121,627	121,886	122,155
Johnson	29,431	29,468	29,491	29,508	29,527	29,545	29,565	29,583	29,603	29,625	29,646
Lubbock	68,278	68,371	68,421	68,469	68,549	68,627	68,707	68,792	68,869	68,959	69,042
McLennan	43,215	43,238	43,273	43,320	43,340	43,361	43,380	43,400	43,420	43,441	43,460
Montgomery	89,563	89,622	89,677	89,722	89,747	89,771	89,794	89,817	89,840	89,864	89,887
Tarrant	372,879	373,363	374,280	374,827	375,193	375,518	375,872	376,217	376,584	376,972	377,340
Travis	123,240	123,514	123,701	123,854	123,992	124,142	124,278	124,420	124,577	124,738	124,886
Williamson	79,413	79,504	79,572	79,636	79,719	79,802	79,886	79,971	80,058	80,143	80,229

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:		
	12/6	12/7	12/8	12/9	12/11	12/13	12/15
Bexar	329,124	329,478	329,711	329,978	330,546 (66,109) [15,866] {7,933}	331,132 (66,226) [15,894] {7,947}	331,744 (66,349) [15,924] {7,962}
Brazoria	61,022	61,050	61,071	61,099	61,144 (12,229) [2,935] {1,467}	61,189 (12,238) [2,937] {1,469}	61,233 (12,247) [2,939] {1,470}
Brazos	39,194	39,222	39,249	39,274	39,313 (7,863) [1,887] {944}	39,350 (7,870) [1,889] {944}	39,390 (7,878) [1,891] {945}
Collin	133,653	133,779	133,834	133,928	134,164 (26,833) [6,440] {3,220}	134,406 (26,881) [6,451] {3,226}	134,654 (26,931) [6,463] {3,232}
Dallas	415,315	415,687	416,696	417,081	417,742 (83,548) [20,052] {10,026}	418,374 (83,675) [20,082] {10,041}	419,065 (83,813) [20,115] {10,058}
Denton	111,758	111,961	112,171	112,396	112,656 (22,531) [5,407] {2,704}	112,918 (22,584) [5,420] {2,710}	113,204 (22,641) [5,434] {2,717}
El Paso	161,605	161,891	162,046	162,139	162,727 (32,545) [7,811] {3,905}	163,299 (32,660) [7,838] {3,919}	163,859 (32,772) [7,865] {3,933}
Ellis	34,173	34,199	34,221	34,233	34,258 (6,852) [1,644] {822}	34,281 (6,856) [1,645] {823}	34,308 (6,862) [1,647] {823}
Fort Bend	103,117	103,408	103,516	103,600	103,876 (20,775) [4,986] {2,493}	104,158 (20,832) [5,000] {2,500}	104,489 (20,898) [5,015] {2,508}
Galveston	65,405	65,437	65,450	65,463	65,502 (13,100) [3,144] {1,572}	65,535 (13,107) [3,146] {1,573}	65,570 (13,114) [3,147] {1,574}
Harris	588,100	588,580	589,253	589,735	590,497 (118,099) [28,344] {14,172}	591,269 (118,254) [28,381] {14,190}	592,054 (118,411) [28,419] {14,209}
Hidalgo	120,274	120,542	120,542	120,542	120,948 (24,190) [5,805] {2,903}	121,393 (24,279) [5,827] {2,913}	121,886 (24,377) [5,851] {2,925}
Johnson	29,431	29,468	29,491	29,508	29,545 (5,909) [1,418] {709}	29,583 (5,917) [1,420] {710}	29,625 (5,925) [1,422] {711}
Lubbock	68,278	68,371	68,421	68,469	68,627 (13,725) [3,294] {1,647}	68,792 (13,758) [3,302] {1,651}	68,959 (13,792) [3,310] {1,655}
McLennan	43,215	43,238	43,273	43,320	43,361 (8,672) [2,081] {1,041}	43,400 (8,680) [2,083] {1,042}	43,441 (8,688) [2,085] {1,043}
Montgomery	89,563	89,622	89,677	89,722	89,771 (17,954) [4,309] {2,155}	89,817 (17,963) [4,311] {2,156}	89,864 (17,973) [4,313] {2,157}
Tarrant	372,879	373,363	374,280	374,827	375,518 (75,104) [18,025] {9,012}	376,217 (75,243) [18,058] {9,029}	376,972 (75,394) [18,095] {9,047}
Travis	123,240	123,514	123,701	123,854	124,142 (24,828) [5,959] {2,979}	124,420 (24,884) [5,972] {2,986}	124,738 (24,948) [5,987] {2,994}
Williamson	79,413	79,504	79,572	79,636	79,802 (15,960) [3,830] {1,915}	79,971 (15,994) [3,839] {1,919}	80,143 (16,029) [3,847] {1,923}

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.