IEM's AI Modeling: Short-term COVID-19 Projections

Date: 12/3/21

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 12/3/21 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.

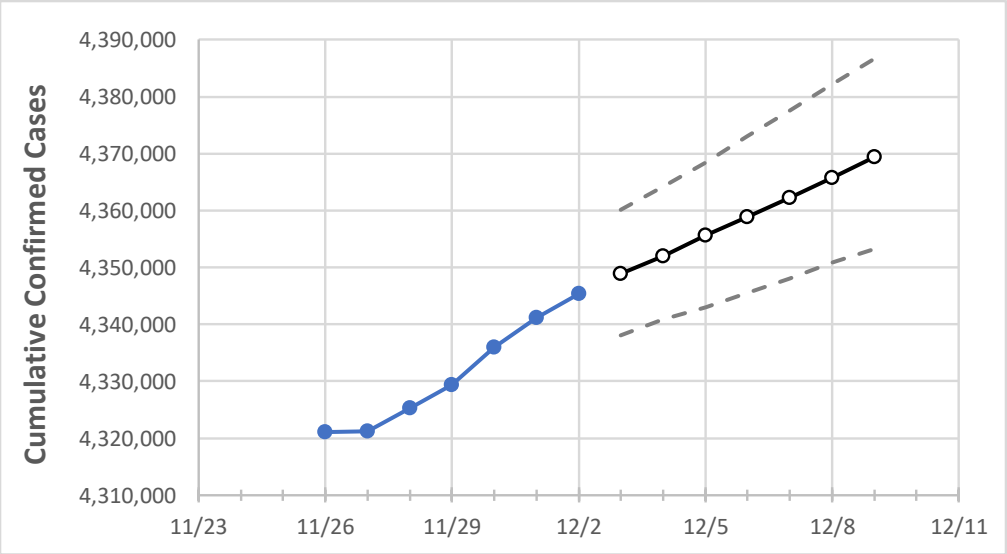
IEM's Modeling Lead

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:						
	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7	12/8	12/9
Texas	4,329,309	4,335,900	4,341,140	4,345,433	4,348,812	4,352,039	4,355,591	4,358,876	4,362,248	4,365,704	4,369,374

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:						
	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7	12/8	12/9
Bexar	327,394	327,592	327,782	328,032	328,220	328,410	328,596	328,783	328,971	329,162	329,350
Brazoria	60,811	60,840	60,881	60,904	60,930	60,952	60,974	60,998	61,020	61,043	61,064
Brazos	39,055	39,082	39,111	39,142	39,160	39,179	39,197	39,215	39,234	39,254	39,274
Collin	133,004	133,141	133,195	133,286	133,433	133,577	133,722	133,872	134,024	134,178	134,337
Dallas	412,836	413,171	414,278	414,567	414,823	415,071	415,309	415,564	415,814	416,098	416,329
Denton	110,758	110,970	111,194	111,445	111,557	111,673	111,785	111,906	112,025	112,145	112,253
El Paso	159,696	160,304	160,504	160,598	161,069	161,552	162,041	162,526	163,044	163,546	164,070
Ellis	34,071	34,108	34,118	34,133	34,139	34,145	34,151	34,157	34,163	34,169	34,174
Fort Bend	101,975	102,680	102,769	102,863	102,984	103,099	103,205	103,329	103,459	103,593	103,710
Galveston	65,195	65,315	65,328	65,336	65,368	65,398	65,426	65,453	65,481	65,510	65,540
Harris	585,480	585,792	586,858	587,310	587,694	588,040	588,402	588,774	589,151	589,570	589,922
Hidalgo	119,238	119,314	119,419	119,605	119,670	119,741	119,807	119,875	119,949	120,024	120,096
Johnson	29,266	29,315	29,328	29,348	29,359	29,369	29,378	29,388	29,397	29,407	29,416
Lubbock	67,465	67,876	67,928	68,031	68,126	68,218	68,315	68,407	68,503	68,609	68,710
McLennan	43,035	43,054	43,073	43,126	43,145	43,162	43,180	43,196	43,213	43,231	43,247
Montgomery	89,348	89,400	89,420	89,441	89,466	89,492	89,516	89,542	89,565	89,588	89,611
Tarrant	370,410	370,665	371,238	371,974	372,226	372,488	372,749	373,003	373,264	373,549	373,798
Travis	122,277	122,630	122,809	122,933	123,037	123,133	123,228	123,332	123,430	123,547	123,635
Williamson	78,777	78,872	78,951	79,049	79,118	79,194	79,264	79,334	79,408	79,481	79,553

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:			
	11/29	11/30	12/1	12/2	12/4	12/6	12/8	
Bexar	327,394	327,592	327,782	328,032	328,410 (65,682) [15,764] {7,882}	328,783 (65,757) [15,782] {7,891}	329,162 (65,832) [15,800] {7,900}	
Brazoria	60,811	60,840	60,881	60,904	60,952 (12,190) [2,926] {1,463}	60,998 (12,200) [2,928] {1,464}	61,043 (12,209) [2,930] {1,465}	
Brazos	39,055	39,082	39,111	39,142	39,179 (7,836) [1,881] {940}	39,215 (7,843) [1,882] {941}	39,254 (7,851) [1,884] {942}	
Collin	133,004	133,141	133,195	133,286	133,577 (26,715) [6,412] {3,206}	133,872 (26,774) [6,426] {3,213}	134,178 (26,836) [6,441] {3,220}	
Dallas	412,836	413,171	414,278	414,567	415,071 (83,014) [19,923] {9,962}	415,564 (83,113) [19,947] {9,974}	416,098 (83,220) [19,973] {9,986}	
Denton	110,758	110,970	111,194	111,445	111,673 (22,335) [5,360] {2,680}	111,906 (22,381) [5,371] {2,686}	112,145 (22,429) [5,383] {2,691}	
El Paso	159,696	160,304	160,504	160,598	161,552 (32,310) [7,754] {3,877}	162,526 (32,505) [7,801] {3,901}	163,546 (32,709) [7,850] {3,925}	
Ellis	34,071	34,108	34,118	34,133	34,145 (6,829) [1,639] {819}	34,157 (6,831) [1,640] {820}	34,169 (6,834) [1,640] {820}	
Fort Bend	101,975	102,680	102,769	102,863	103,099 (20,620) [4,949] {2,474}	103,329 (20,666) [4,960] {2,480}	103,593 (20,719) [4,972] {2,486}	
Galveston	65,195	65,315	65,328	65,336	65,398 (13,080) [3,139] {1,570}	65,453 (13,091) [3,142] {1,571}	65,510 (13,102) [3,144] {1,572}	
Harris	585,480	585,792	586,858	587,310	588,040 (117,608) [28,226] {14,113}	588,774 (117,755) [28,261] {14,131}	589,570 (117,914) [28,299] {14,150}	
Hidalgo	119,238	119,314	119,419	119,605	119,741 (23,948) [5,748] {2,874}	119,875 (23,975) [5,754] {2,877}	120,024 (24,005) [5,761] {2,881}	
Johnson	29,266	29,315	29,328	29,348	29,369 (5,874) [1,410] {705}	29,388 (5,878) [1,411] {705}	29,407 (5,881) [1,412] {706}	
Lubbock	67,465	67,876	67,928	68,031	68,218 (13,644) [3,274] {1,637}	68,407 (13,681) [3,284] {1,642}	68,609 (13,722) [3,293] {1,647}	
McLennan	43,035	43,054	43,073	43,126	43,162 (8,632) [2,072] {1,036}	43,196 (8,639) [2,073] {1,037}	43,231 (8,646) [2,075] {1,038}	
Montgomery	89,348	89,400	89,420	89,441	89,492 (17,898) [4,296] {2,148}	89,542 (17,908) [4,298] {2,149}	89,588 (17,918) [4,300] {2,150}	
Tarrant	370,410	370,665	371,238	371,974	372,488 (74,498) [17,879] {8,940}	373,003 (74,601) [17,904] {8,952}	373,549 (74,710) [17,930] {8,965}	
Travis	122,277	122,630	122,809	122,933	123,133 (24,627) [5,910] {2,955}	123,332 (24,666) [5,920] {2,960}	123,547 (24,709) [5,930] {2,965}	
Williamson	78,777	78,872	78,951	79,049	79,194 (15,839) [3,801] {1,901}	79,334 (15,867) [3,808] {1,904}	79,481 (15,896) [3,815] {1,908}	

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.