IEM's AI Modeling: Short-term COVID-19 Projections
Date: 12/8/21

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 12/8/21 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
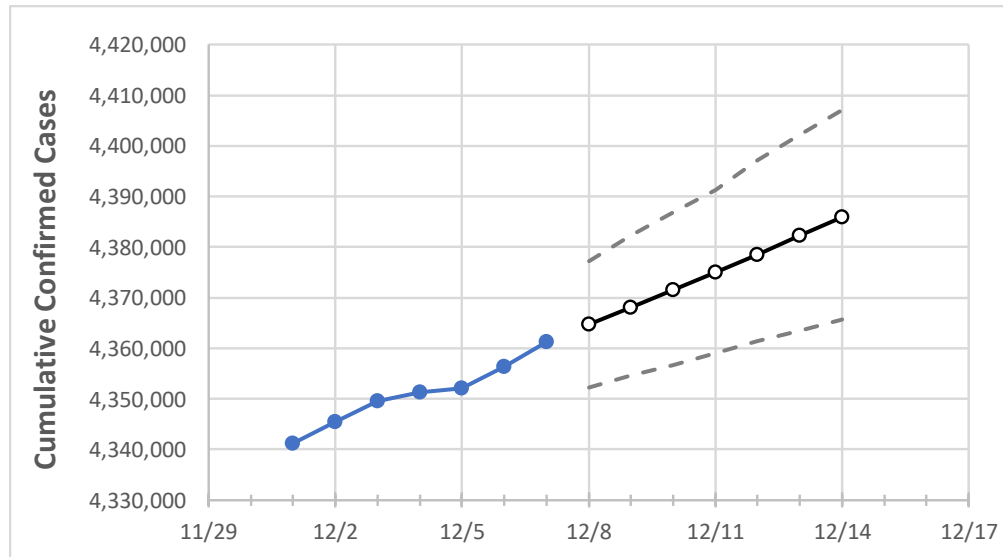
	Actual Confirmed Cases On:				Projected Cases For:						
	12/4	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14
Texas	4,351,335	4,352,098	4,356,275	4,361,295	4,364,730	4,368,089	4,371,519	4,375,055	4,378,533	4,382,331	4,385,863

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:						
	12/4	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14
Bexar	328,557	328,841	329,124	329,478	329,848	330,247	330,677	331,139	331,631	332,154	332,706
Brazoria	60,969	60,990	61,022	61,050	61,072	61,092	61,112	61,134	61,153	61,176	61,197
Brazos	39,176	39,185	39,194	39,222	39,238	39,255	39,271	39,286	39,303	39,319	39,336
Collin	133,444	133,492	133,653	133,779	133,911	134,052	134,182	134,323	134,463	134,599	134,739
Dallas	415,028	415,172	415,315	415,687	415,941	416,139	416,361	416,588	416,833	417,044	417,291
Denton	111,667	111,712	111,758	111,961	112,069	112,166	112,282	112,389	112,503	112,604	112,723
El Paso	161,115	161,269	161,605	161,891	162,232	162,558	162,889	163,217	163,541	163,866	164,183
Ellis	34,159	34,163	34,173	34,199	34,211	34,221	34,231	34,242	34,253	34,264	34,275
Fort Bend	103,033	103,075	103,117	103,408	103,560	103,718	103,854	104,016	104,188	104,339	104,513
Galveston	65,367	65,385	65,405	65,437	65,457	65,478	65,497	65,517	65,535	65,555	65,572
Harris	588,000	588,050	588,100	588,580	588,907	589,249	589,593	589,916	590,280	590,624	590,975
Hidalgo	120,081	120,177	120,274	120,542	120,717	120,897	121,097	121,299	121,513	121,743	121,974
Johnson	29,406	29,419	29,431	29,468	29,486	29,504	29,522	29,540	29,559	29,578	29,597
Lubbock	68,210	68,248	68,278	68,371	68,452	68,550	68,625	68,717	68,807	68,895	68,989
McLennan	43,180	43,198	43,215	43,238	43,255	43,269	43,285	43,301	43,315	43,331	43,346
Montgomery	89,520	89,536	89,563	89,622	89,643	89,662	89,680	89,700	89,717	89,735	89,755
Tarrant	372,589	372,734	372,879	373,363	373,591	373,858	374,103	374,323	374,567	374,838	375,103
Travis	123,107	123,173	123,240	123,514	123,633	123,754	123,874	124,001	124,123	124,260	124,393
Williamson	79,231	79,322	79,413	79,504	79,596	79,688	79,781	79,877	79,972	80,069	80,167

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:		
	12/4	12/5	12/6	12/7	12/9	12/11	12/13
Bexar	328,557	328,841	329,124	329,478	330,247 (66,049) [15,852] {7,926}	331,139 (66,228) [15,895] {7,947}	332,154 (66,431) [15,943] {7,972}
Brazoria	60,969	60,990	61,022	61,050	61,092 (12,218) [2,932] {1,466}	61,134 (12,227) [2,934] {1,467}	61,176 (12,235) [2,936] {1,468}
Brazos	39,176	39,185	39,194	39,222	39,255 (7,851) [1,884] {942}	39,286 (7,857) [1,886] {943}	39,319 (7,864) [1,887] {944}
Collin	133,444	133,492	133,653	133,779	134,052 (26,810) [6,435] {3,217}	134,323 (26,865) [6,448] {3,224}	134,599 (26,920) [6,461] {3,230}
Dallas	415,028	415,172	415,315	415,687	416,139 (83,228) [19,975] {9,987}	416,588 (83,318) [19,996] {9,998}	417,044 (83,409) [20,018] {10,009}
Denton	111,667	111,712	111,758	111,961	112,166 (22,433) [5,384] {2,692}	112,389 (22,478) [5,395] {2,697}	112,604 (22,521) [5,405] {2,702}
El Paso	161,115	161,269	161,605	161,891	162,558 (32,512) [7,803] {3,901}	163,217 (32,643) [7,834] {3,917}	163,866 (32,773) [7,866] {3,933}
Ellis	34,159	34,163	34,173	34,199	34,221 (6,844) [1,643] {821}	34,242 (6,848) [1,644] {822}	34,264 (6,853) [1,645] {822}
Fort Bend	103,033	103,075	103,117	103,408	103,718 (20,744) [4,978] {2,489}	104,016 (20,803) [4,993] {2,496}	104,339 (20,868) [5,008] {2,504}
Galveston	65,367	65,385	65,405	65,437	65,478 (13,096) [3,143] {1,571}	65,517 (13,103) [3,145] {1,572}	65,555 (13,111) [3,147] {1,573}
Harris	588,000	588,050	588,100	588,580	589,249 (117,850) [28,284] {14,142}	589,916 (117,983) [28,316] {14,158}	590,624 (118,125) [28,350] {14,175}
Hidalgo	120,081	120,177	120,274	120,542	120,897 (24,179) [5,803] {2,902}	121,299 (24,260) [5,822] {2,911}	121,743 (24,349) [5,844] {2,922}
Johnson	29,406	29,419	29,431	29,468	29,504 (5,901) [1,416] {708}	29,540 (5,908) [1,418] {709}	29,578 (5,916) [1,420] {710}
Lubbock	68,210	68,248	68,278	68,371	68,550 (13,710) [3,290] {1,645}	68,717 (13,743) [3,298] {1,649}	68,895 (13,779) [3,307] {1,653}
McLennan	43,180	43,198	43,215	43,238	43,269 (8,654) [2,077] {1,038}	43,301 (8,660) [2,078] {1,039}	43,331 (8,666) [2,080] {1,040}
Montgomery	89,520	89,536	89,563	89,622	89,662 (17,932) [4,304] {2,152}	89,700 (17,940) [4,306] {2,153}	89,735 (17,947) [4,307] {2,154}
Tarrant	372,589	372,734	372,879	373,363	373,858 (74,772) [17,945] {8,973}	374,323 (74,865) [17,968] {8,984}	374,838 (74,968) [17,992] {8,996}
Travis	123,107	123,173	123,240	123,514	123,754 (24,751) [5,940] {2,970}	124,001 (24,800) [5,952] {2,976}	124,260 (24,852) [5,964] {2,982}
Williamson	79,231	79,322	79,413	79,504	79,688 (15,938) [3,825] {1,913}	79,877 (15,975) [3,834] {1,917}	80,069 (16,014) [3,843] {1,922}

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.