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

Date: 7/23/21

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 7/23/21 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.

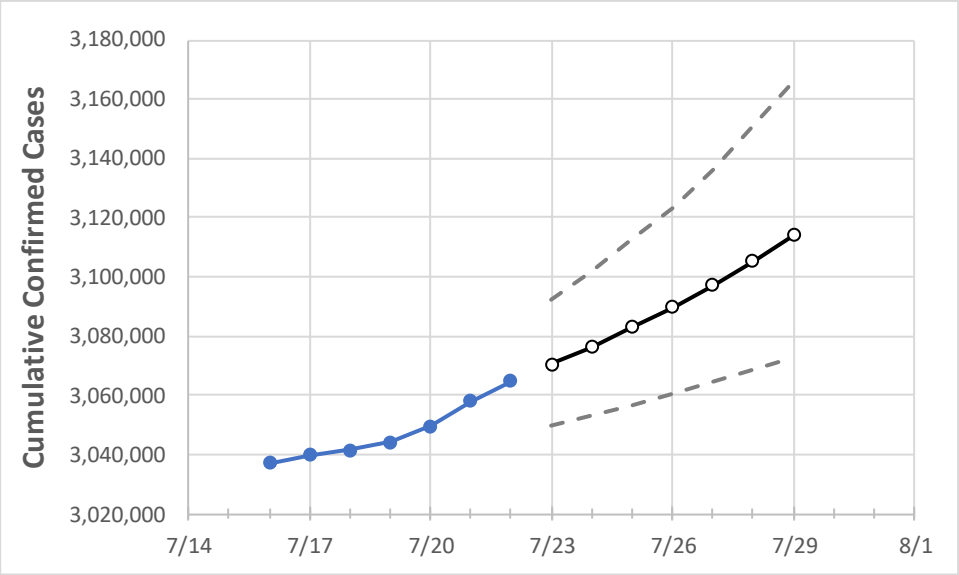
IEM's Modeling Lead

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:						
	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27	7/28	7/29
Texas	3,044,072	3,049,688	3,057,874	3,064,743	3,070,379	3,076,353	3,082,851	3,089,813	3,097,292	3,105,194	3,113,919

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:						
	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26	7/27	7/28	7/29
Bexar	232,440	232,804	233,167	233,167	233,598	234,046	234,514	234,995	235,496	236,018	236,557
Brazoria	39,659	39,691	39,743	39,880	39,969	40,065	40,167	40,275	40,390	40,512	40,640
Brazos	28,290	28,330	28,400	28,420	28,452	28,486	28,521	28,558	28,599	28,640	28,683
Collin	94,142	94,207	94,430	94,617	94,731	94,848	94,973	95,106	95,248	95,383	95,534
Dallas	309,851	310,721	311,380	311,720	312,166	312,642	313,158	313,689	314,262	314,868	315,509
Denton	78,102	78,267	78,476	78,678	78,836	79,007	79,190	79,390	79,600	79,830	80,074
El Paso	137,237	137,353	137,404	137,440	137,502	137,570	137,640	137,714	137,792	137,873	137,958
Ellis	23,272	23,273	23,267	23,318	23,339	23,362	23,387	23,411	23,437	23,466	23,493
Fort Bend	70,852	71,003	71,108	71,336	71,466	71,601	71,740	71,894	72,064	72,244	72,432
Galveston	42,198	42,274	42,405	42,507	42,616	42,730	42,850	42,978	43,109	43,250	43,396
Harris	408,097	408,628	409,418	411,095	411,819	412,550	413,359	414,218	415,202	416,228	417,318
Hidalgo	94,887	95,083	95,306	95,707	95,877	96,051	96,232	96,425	96,634	96,842	97,062
Johnson	20,353	20,355	20,360	20,402	20,417	20,433	20,449	20,465	20,481	20,499	20,518
Lubbock	49,872	49,893	49,966	50,070	50,131	50,197	50,272	50,355	50,447	50,549	50,657
McLennan	28,132	28,132	28,132	28,132	28,154	28,176	28,198	28,221	28,245	28,270	28,295
Montgomery	56,537	56,561	57,017	57,017	57,174	57,344	57,529	57,721	57,940	58,176	58,442
Tarrant	267,435	267,874	268,194	268,548	269,130	269,767	270,456	271,214	272,029	272,916	273,879
Travis	86,079	86,361	86,524	86,826	87,031	87,255	87,500	87,764	88,053	88,355	88,687
Williamson	48,530	48,631	48,726	48,965	49,136	49,322	49,522	49,740	49,973	50,227	50,509

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:		
	7/19	7/20	7/21	7/22	7/24	7/26	7/28
Bexar	232,440	232,804	233,167	233,167	234,046 (46,809) [11,234] {5,617}	234,995 (46,999) [11,280] {5,640}	236,018 (47,204) [11,329] {5,664}
Brazoria	39,659	39,691	39,743	39,880	40,065 (8,013) [1,923] {962}	40,275 (8,055) [1,933] {967}	40,512 (8,102) [1,945] {972}
Brazos	28,290	28,330	28,400	28,420	28,486 (5,697) [1,367] {684}	28,558 (5,712) [1,371] {685}	28,640 (5,728) [1,375] {687}
Collin	94,142	94,207	94,430	94,617	94,848 (18,970) [4,553] {2,276}	95,106 (19,021) [4,565] {2,283}	95,383 (19,077) [4,578] {2,289}
Dallas	309,851	310,721	311,380	311,720	312,642 (62,528) [15,007] {7,503}	313,689 (62,738) [15,057] {7,529}	314,868 (62,974) [15,114] {7,557}
Denton	78,102	78,267	78,476	78,678	79,007 (15,801) [3,792] {1,896}	79,390 (15,878) [3,811] {1,905}	79,830 (15,966) [3,832] {1,916}
El Paso	137,237	137,353	137,404	137,440	137,570 (27,514) [6,603] {3,302}	137,714 (27,543) [6,610] {3,305}	137,873 (27,575) [6,618] {3,309}
Ellis	23,272	23,273	23,267	23,318	23,362 (4,672) [1,121] {561}	23,411 (4,682) [1,124] {562}	23,466 (4,693) [1,126] {563}
Fort Bend	70,852	71,003	71,108	71,336	71,601 (14,320) [3,437] {1,718}	71,894 (14,379) [3,451] {1,725}	72,244 (14,449) [3,468] {1,734}
Galveston	42,198	42,274	42,405	42,507	42,730 (8,546) [2,051] {1,026}	42,978 (8,596) [2,063] {1,031}	43,250 (8,650) [2,076] {1,038}
Harris	408,097	408,628	409,418	411,095	412,550 (82,510) [19,802] {9,901}	414,218 (82,844) [19,882] {9,941}	416,228 (83,246) [19,979] {9,989}
Hidalgo	94,887	95,083	95,306	95,707	96,051 (19,210) [4,610] {2,305}	96,425 (19,285) [4,628] {2,314}	96,842 (19,368) [4,648] {2,324}
Johnson	20,353	20,355	20,360	20,402	20,433 (4,087) [981] {490}	20,465 (4,093) [982] {491}	20,499 (4,100) [984] {492}
Lubbock	49,872	49,893	49,966	50,070	50,197 (10,039) [2,409] {1,205}	50,355 (10,071) [2,417] {1,209}	50,549 (10,110) [2,426] {1,213}
McLennan	28,132	28,132	28,132	28,132	28,176 (5,635) [1,352] {676}	28,221 (5,644) [1,355] {677}	28,270 (5,654) [1,357] {678}
Montgomery	56,537	56,561	57,017	57,017	57,344 (11,469) [2,753] {1,376}	57,721 (11,544) [2,771] {1,385}	58,176 (11,635) [2,792] {1,396}
Tarrant	267,435	267,874	268,194	268,548	269,767 (53,953) [12,949] {6,474}	271,214 (54,243) [13,018] {6,509}	272,916 (54,583) [13,100] {6,550}
Travis	86,079	86,361	86,524	86,826	87,255 (17,451) [4,188] {2,094}	87,764 (17,553) [4,213] {2,106}	88,355 (17,671) [4,241] {2,121}
Williamson	48,530	48,631	48,726	48,965	49,322 (9,864) [2,367] {1,184}	49,740 (9,948) [2,388] {1,194}	50,227 (10,045) [2,411] {1,205}

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.