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

Date: 9/24/20

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 9/24/20 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.

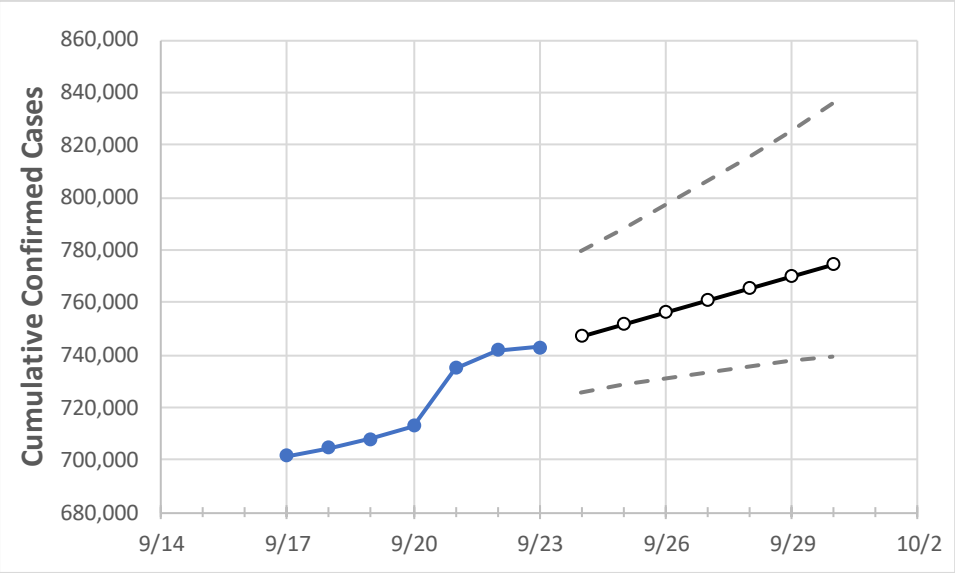
IEM's Modeling Lead

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:						
	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30
Texas	713,007	734,778	741,663	742,913	747,266	751,675	756,143	760,668	765,253	769,897	774,600

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 20%, and are often within 10%, of actual confirmed cases.

Texas Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	9/20	9/21	9/22	9/23	9/24	9/25	9/26	9/27	9/28	9/29	9/30
Bexar	53,341	53,443	56,639	53,794	53,968	54,145	54,326	54,510	54,697	54,888	55,084
Brazoria	11,034	11,047	11,045	11,144	11,199	11,253	11,307	11,361	11,414	11,468	11,521
Brazos	6,081	6,102	6,122	6,178	6,214	6,248	6,282	6,315	6,347	6,378	6,409
Collin	12,966	13,011	13,060	13,210	13,315	13,424	13,535	13,649	13,767	13,888	14,012
Dallas	77,889	78,205	78,464	78,723	78,970	79,216	79,461	79,705	79,949	80,192	80,435
Denton	11,554	11,607	11,702	11,770	11,833	11,895	11,958	12,021	12,084	12,147	12,210
El Paso	22,476	22,652	22,821	22,821	22,937	23,054	23,174	23,296	23,419	23,545	23,673
Ellis	4,242	4,266	4,291	4,298	4,318	4,337	4,357	4,376	4,396	4,415	4,435
Fort Bend	15,802	15,814	15,908	16,049	16,086	16,123	16,160	16,198	16,235	16,273	16,311
Galveston	11,450	11,462	11,473	11,497	11,512	11,525	11,539	11,551	11,563	11,575	11,586
Harris	123,817	137,946	138,473	139,017	139,983	140,967	141,968	142,988	144,026	145,083	146,159
Hidalgo	30,688	30,743	30,998	31,162	31,256	31,348	31,438	31,526	31,613	31,698	31,781
Johnson	2,843	2,867	2,891	2,905	2,923	2,942	2,961	2,980	3,000	3,021	3,042
Lubbock	10,312	10,455	10,515	10,681	10,777	10,872	10,967	11,061	11,155	11,249	11,342
McLennan	7,487	7,520	7,571	7,626	7,675	7,723	7,772	7,820	7,868	7,916	7,964
Montgomery	10,634	10,666	10,711	10,747	10,804	10,860	10,914	10,968	11,020	11,070	11,120
Tarrant	46,898	47,231	47,533	47,917	48,312	48,721	49,144	49,583	50,038	50,508	50,996
Travis	28,441	28,596	28,643	28,745	28,814	28,882	28,950	29,017	29,084	29,149	29,215
Williamson	8,434	8,458	8,476	8,515	8,545	8,576	8,607	8,639	8,671	8,704	8,738

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:		
	9/20	9/21	9/22	9/23	9/25	9/27	9/29
Bexar	53,341	53,443	56,639	53,794	54,145 (10,829) [2,599] {1,299}	54,510 (10,902) [2,616] {1,308}	54,888 (10,978) [2,635] {1,317}
Brazoria	11,034	11,047	11,045	11,144	11,253 (2,251) [540] {270}	11,361 (2,272) [545] {273}	11,468 (2,294) [550] {275}
Brazos	6,081	6,102	6,122	6,178	6,248 (1,250) [300] {150}	6,315 (1,263) [303] {152}	6,378 (1,276) [306] {153}
Collin	12,966	13,011	13,060	13,210	13,424 (2,685) [644] {322}	13,649 (2,730) [655] {328}	13,888 (2,778) [667] {333}
Dallas	77,889	78,205	78,464	78,723	79,216 (15,843) [3,802] {1,901}	79,705 (15,941) [3,826] {1,913}	80,192 (16,038) [3,849] {1,925}
Denton	11,554	11,607	11,702	11,770	11,895 (2,379) [571] {285}	12,021 (2,404) [577] {289}	12,147 (2,429) [583] {292}
El Paso	22,476	22,652	22,821	22,821	23,054 (4,611) [1,107] {553}	23,296 (4,659) [1,118] {559}	23,545 (4,709) [1,130] {565}
Ellis	4,242	4,266	4,291	4,298	4,337 (867) [208] {104}	4,376 (875) [210] {105}	4,415 (883) [212] {106}
Fort Bend	15,802	15,814	15,908	16,049	16,123 (3,225) [774] {387}	16,198 (3,240) [777] {389}	16,273 (3,255) [781] {391}
Galveston	11,450	11,462	11,473	11,497	11,525 (2,305) [553] {277}	11,551 (2,310) [554] {277}	11,575 (2,315) [556] {278}
Harris	123,817	137,946	138,473	139,017	140,967 (28,193) [6,766] {3,383}	142,988 (28,598) [6,863] {3,432}	145,083 (29,017) [6,964] {3,482}
Hidalgo	30,688	30,743	30,998	31,162	31,348 (6,270) [1,505] {752}	31,526 (6,305) [1,513] {757}	31,698 (6,340) [1,521] {761}
Johnson	2,843	2,867	2,891	2,905	2,942 (588) [141] {71}	2,980 (596) [143] {72}	3,021 (604) [145] {72}
Lubbock	10,312	10,455	10,515	10,681	10,872 (2,174) [522] {261}	11,061 (2,212) [531] {265}	11,249 (2,250) [540] {270}
McLennan	7,487	7,520	7,571	7,626	7,723 (1,545) [371] {185}	7,820 (1,564) [375] {188}	7,916 (1,583) [380] {190}
Montgomery	10,634	10,666	10,711	10,747	10,860 (2,172) [521] {261}	10,968 (2,194) [526] {263}	11,070 (2,214) [531] {266}
Tarrant	46,898	47,231	47,533	47,917	48,721 (9,744) [2,339] {1,169}	49,583 (9,917) [2,380] {1,190}	50,508 (10,102) [2,424] {1,212}
Travis	28,441	28,596	28,643	28,745	28,882 (5,776) [1,386] {693}	29,017 (5,803) [1,393] {696}	29,149 (5,830) [1,399] {700}
Williamson	8,434	8,458	8,476	8,515	8,576 (1,715) [412] {206}	8,639 (1,728) [415] {207}	8,704 (1,741) [418] {209}

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.