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

Date: 9/30/20

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 9/30/20 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.

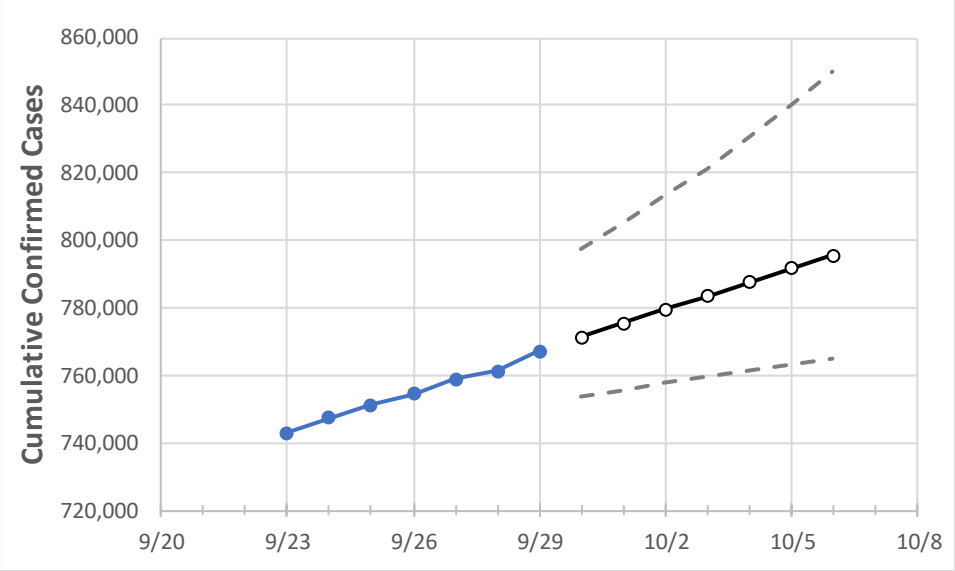
IEM's Modeling Lead

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:						
	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3	10/4	10/5	10/6
Texas	754,311	758,756	761,198	767,264	771,329	775,386	779,435	783,476	787,509	791,535	795,553

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:						
	9/26	9/27	9/28	9/29	9/30	10/1	10/2	10/3	10/4	10/5	10/6
Bexar	54,295	57,145	57,208	57,677	57,971	58,277	58,595	58,925	59,267	59,623	59,993
Brazoria	11,281	11,338	11,395	11,412	11,445	11,477	11,508	11,538	11,566	11,594	11,620
Brazos	6,332	6,367	6,402	6,453	6,486	6,518	6,550	6,580	6,610	6,639	6,667
Collin	13,513	13,537	13,770	13,825	13,890	13,954	14,018	14,080	14,142	14,202	14,262
Dallas	80,605	81,175	81,372	82,161	82,678	83,217	83,779	84,364	84,973	85,608	86,269
Denton	11,985	12,022	12,058	12,148	12,202	12,254	12,306	12,358	12,408	12,457	12,506
El Paso	23,604	23,784	23,905	24,170	24,401	24,642	24,895	25,160	25,437	25,726	26,030
Ellis	4,398	4,415	4,433	4,450	4,463	4,475	4,488	4,500	4,511	4,523	4,534
Fort Bend	16,207	16,251	16,295	16,387	16,437	16,489	16,541	16,594	16,648	16,704	16,760
Galveston	11,575	11,604	11,620	11,636	11,652	11,668	11,684	11,699	11,714	11,728	11,742
Harris	140,868	141,353	141,707	142,315	142,852	143,374	143,879	144,369	144,845	145,307	145,754
Hidalgo	31,600	31,639	31,677	31,835	31,905	31,971	32,034	32,093	32,150	32,203	32,254
Johnson	3,011	3,041	3,072	3,102	3,138	3,177	3,217	3,260	3,304	3,352	3,401
Lubbock	11,241	11,324	11,422	11,764	11,921	12,082	12,249	12,421	12,599	12,782	12,972
McLennan	7,942	7,983	8,000	8,061	8,115	8,169	8,224	8,278	8,333	8,389	8,444
Montgomery	10,847	10,879	10,912	10,996	11,026	11,055	11,081	11,107	11,131	11,154	11,175
Tarrant	47,917	47,917	47,917	47,917	48,866	49,906	51,048	52,302	53,677	55,185	56,837
Travis	29,130	29,252	29,343	29,421	29,495	29,570	29,644	29,717	29,791	29,864	29,937
Williamson	8,585	8,604	8,624	8,642	8,663	8,684	8,705	8,726	8,746	8,765	8,785

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:		
	9/26	9/27	9/28	9/29	10/1	10/3	10/5
Bexar	54,295	57,145	57,208	57,677	58,277 (11,655) [2,797] {1,399}	58,925 (11,785) [2,828] {1,414}	59,623 (11,925) [2,862] {1,431}
Brazoria	11,281	11,338	11,395	11,412	11,477 (2,295) [551] {275}	11,538 (2,308) [554] {277}	11,594 (2,319) [557] {278}
Brazos	6,332	6,367	6,402	6,453	6,518 (1,304) [313] {156}	6,580 (1,316) [316] {158}	6,639 (1,328) [319] {159}
Collin	13,513	13,537	13,770	13,825	13,954 (2,791) [670] {335}	14,080 (2,816) [676] {338}	14,202 (2,840) [682] {341}
Dallas	80,605	81,175	81,372	82,161	83,217 (16,643) [3,994] {1,997}	84,364 (16,873) [4,049] {2,025}	85,608 (17,122) [4,109] {2,055}
Denton	11,985	12,022	12,058	12,148	12,254 (2,451) [588] {294}	12,358 (2,472) [593] {297}	12,457 (2,491) [598] {299}
El Paso	23,604	23,784	23,905	24,170	24,642 (4,928) [1,183] {591}	25,160 (5,032) [1,208] {604}	25,726 (5,145) [1,235] {617}
Ellis	4,398	4,415	4,433	4,450	4,475 (895) [215] {107}	4,500 (900) [216] {108}	4,523 (905) [217] {109}
Fort Bend	16,207	16,251	16,295	16,387	16,489 (3,298) [791] {396}	16,594 (3,319) [797] {398}	16,704 (3,341) [802] {401}
Galveston	11,575	11,604	11,620	11,636	11,668 (2,334) [560] {280}	11,699 (2,340) [562] {281}	11,728 (2,346) [563] {281}
Harris	140,868	141,353	141,707	142,315	143,374 (28,675) [6,882] {3,441}	144,369 (28,874) [6,930] {3,465}	145,307 (29,061) [6,975] {3,487}
Hidalgo	31,600	31,639	31,677	31,835	31,971 (6,394) [1,535] {767}	32,093 (6,419) [1,540] {770}	32,203 (6,441) [1,546] {773}
Johnson	3,011	3,041	3,072	3,102	3,177 (635) [152] {76}	3,260 (652) [156] {78}	3,352 (670) [161] {80}
Lubbock	11,241	11,324	11,422	11,764	12,082 (2,416) [580] {290}	12,421 (2,484) [596] {298}	12,782 (2,556) [614] {307}
McLennan	7,942	7,983	8,000	8,061	8,169 (1,634) [392] {196}	8,278 (1,656) [397] {199}	8,389 (1,678) [403] {201}
Montgomery	10,847	10,879	10,912	10,996	11,055 (2,211) [531] {265}	11,107 (2,221) [533] {267}	11,154 (2,231) [535] {268}
Tarrant	47,917	47,917	47,917	47,917	49,906 (9,981) [2,395] {1,198}	52,302 (10,460) [2,510] {1,255}	55,185 (11,037) [2,649] {1,324}
Travis	29,130	29,252	29,343	29,421	29,570 (5,914) [1,419] {710}	29,717 (5,943) [1,426] {713}	29,864 (5,973) [1,433] {717}
Williamson	8,585	8,604	8,624	8,642	8,684 (1,737) [417] {208}	8,726 (1,745) [419] {209}	8,765 (1,753) [421] {210}

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.