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

Date: 9/10/20

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

The projections shown in this document are based on data pulled in as of 9/10/20 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.

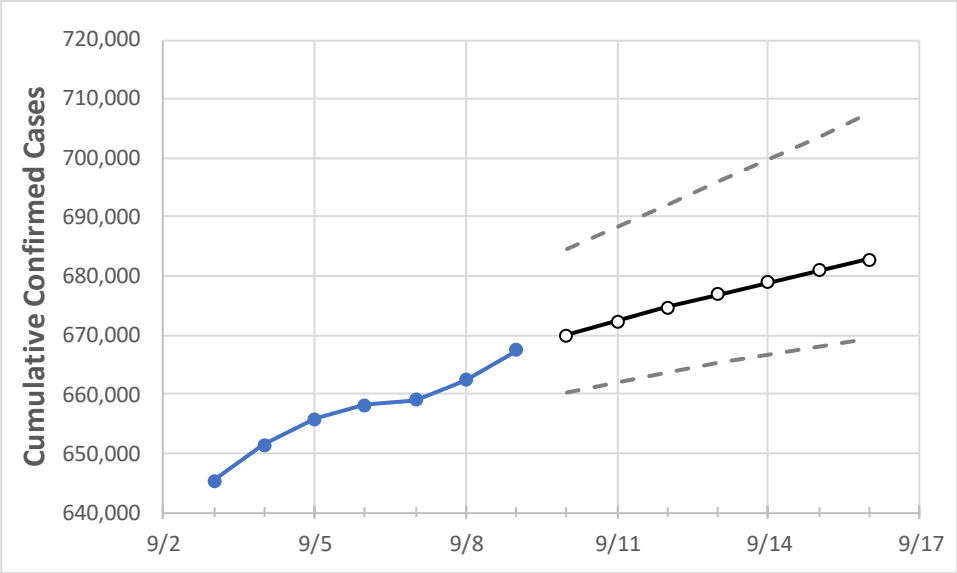
IEM's Modeling Lead

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:						
	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16
Texas	658,202	659,041	662,427	667,500	669,984	672,364	674,643	676,825	678,914	680,915	682,830

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:						
	9/6	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16
Bexar	47,543	47,640	47,736	47,887	48,011	48,133	48,253	48,372	48,489	48,604	48,717
Brazoria	9,817	9,882	9,924	10,004	10,075	10,146	10,217	10,288	10,358	10,429	10,500
Brazos	5,271	5,359	5,442	5,506	5,572	5,667	5,761	5,853	5,940	6,026	6,107
Collin	11,481	11,534	11,632	11,676	11,748	11,822	11,897	11,974	12,053	12,134	12,217
Dallas	73,700	73,900	74,100	74,476	74,700	74,917	75,128	75,332	75,531	75,724	75,911
Denton	10,614	10,639	10,766	10,847	10,897	10,945	10,991	11,035	11,076	11,116	11,154
El Paso	20,939	21,093	21,187	21,259	21,332	21,403	21,471	21,536	21,599	21,659	21,717
Ellis	3,904	3,920	3,935	3,951	3,964	3,976	3,987	3,998	4,008	4,018	4,027
Fort Bend	15,149	15,153	15,158	15,249	15,270	15,289	15,307	15,325	15,342	15,357	15,372
Galveston	10,874	10,941	11,007	11,101	11,148	11,196	11,245	11,295	11,345	11,397	11,450
Harris	111,525	111,782	112,039	112,762	113,248	113,715	114,163	114,593	115,006	115,402	115,783
Hidalgo	28,591	28,732	28,893	29,082	29,188	29,288	29,384	29,476	29,563	29,646	29,725
Johnson	2,594	2,601	2,608	2,615	2,622	2,628	2,635	2,640	2,646	2,651	2,656
Lubbock	8,867	8,912	8,983	9,075	9,164	9,354	9,529	9,708	9,882	10,070	10,237
McLennan	6,707	6,726	6,766	6,813	6,855	6,895	6,934	6,971	7,008	7,043	7,077
Montgomery	9,271	9,324	9,377	9,466	9,530	9,595	9,659	9,723	9,788	9,852	9,916
Tarrant	42,884	42,969	43,055	43,515	43,656	43,791	43,922	44,047	44,167	44,282	44,393
Travis	26,969	27,038	27,124	27,206	27,254	27,300	27,343	27,385	27,425	27,463	27,500
Williamson	8,058	8,075	8,092	8,107	8,120	8,132	8,143	8,154	8,164	8,174	8,183

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:		
	9/6	9/7	9/8	9/9	9/11	9/13	9/15
Bexar	47,543	47,640	47,736	47,887	48,133 (9,627) [2,310] {1,155}	48,372 (9,674) [2,322] {1,161}	48,604 (9,721) [2,333] {1,166}
Brazoria	9,817	9,882	9,924	10,004	10,146 (2,029) [487] {244}	10,288 (2,058) [494] {247}	10,429 (2,086) [501] {250}
Brazos	5,271	5,359	5,442	5,506	5,667 (1,133) [272] {136}	5,853 (1,171) [281] {140}	6,026 (1,205) [289] {145}
Collin	11,481	11,534	11,632	11,676	11,822 (2,364) [567] {284}	11,974 (2,395) [575] {287}	12,134 (2,427) [582] {291}
Dallas	73,700	73,900	74,100	74,476	74,917 (14,983) [3,596] {1,798}	75,332 (15,066) [3,616] {1,808}	75,724 (15,145) [3,635] {1,817}
Denton	10,614	10,639	10,766	10,847	10,945 (2,189) [525] {263}	11,035 (2,207) [530] {265}	11,116 (2,223) [534] {267}
El Paso	20,939	21,093	21,187	21,259	21,403 (4,281) [1,027] {514}	21,536 (4,307) [1,034] {517}	21,659 (4,332) [1,040] {520}
Ellis	3,904	3,920	3,935	3,951	3,976 (795) [191] {95}	3,998 (800) [192] {96}	4,018 (804) [193] {96}
Fort Bend	15,149	15,153	15,158	15,249	15,289 (3,058) [734] {367}	15,325 (3,065) [736] {368}	15,357 (3,071) [737] {369}
Galveston	10,874	10,941	11,007	11,101	11,196 (2,239) [537] {269}	11,295 (2,259) [542] {271}	11,397 (2,279) [547] {274}
Harris	111,525	111,782	112,039	112,762	113,715 (22,743) [5,458] {2,729}	114,593 (22,919) [5,500] {2,750}	115,402 (23,080) [5,539] {2,770}
Hidalgo	28,591	28,732	28,893	29,082	29,288 (5,858) [1,406] {703}	29,476 (5,895) [1,415] {707}	29,646 (5,929) [1,423] {711}
Johnson	2,594	2,601	2,608	2,615	2,628 (526) [126] {63}	2,640 (528) [127] {63}	2,651 (530) [127] {64}
Lubbock	8,867	8,912	8,983	9,075	9,354 (1,871) [449] {224}	9,708 (1,942) [466] {233}	10,070 (2,014) [483] {242}
McLennan	6,707	6,726	6,766	6,813	6,895 (1,379) [331] {165}	6,971 (1,394) [335] {167}	7,043 (1,409) [338] {169}
Montgomery	9,271	9,324	9,377	9,466	9,595 (1,919) [461] {230}	9,723 (1,945) [467] {233}	9,852 (1,970) [473] {236}
Tarrant	42,884	42,969	43,055	43,515	43,791 (8,758) [2,102] {1,051}	44,047 (8,809) [2,114] {1,057}	44,282 (8,856) [2,126] {1,063}
Travis	26,969	27,038	27,124	27,206	27,300 (5,460) [1,310] {655}	27,385 (5,477) [1,314] {657}	27,463 (5,493) [1,318] {659}
Williamson	8,058	8,075	8,092	8,107	8,132 (1,626) [390] {195}	8,154 (1,631) [391] {196}	8,174 (1,635) [392] {196}

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.