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

Date: 11/5/20

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 11/5/20 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.

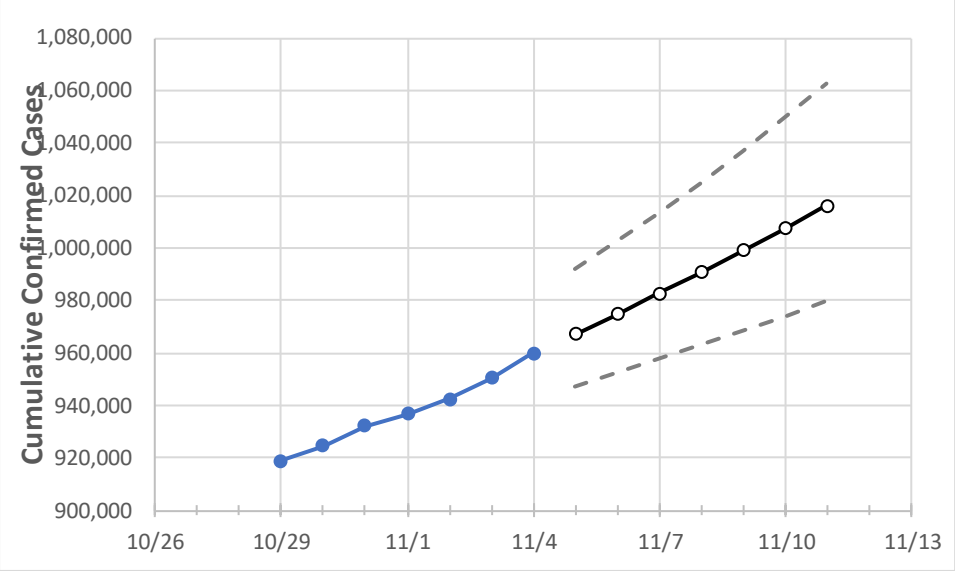
IEM's Modeling Lead

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:						
	11/1	11/2	11/3	11/4	11/5	11/6	11/7	11/8	11/9	11/10	11/11
Texas	936,816	942,303	950,302	959,811	967,202	974,801	982,612	990,641	998,893	########	########

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:						
	11/1	11/2	11/3	11/4	11/5	11/6	11/7	11/8	11/9	11/10	11/11
Bexar	66,064	66,231	66,529	66,714	66,925	67,137	67,350	67,564	67,779	67,995	68,212
Brazoria	12,594	12,687	12,703	12,718	12,758	12,799	12,840	12,882	12,925	12,968	13,012
Brazos	7,782	7,814	7,856	7,912	7,950	7,988	8,027	8,066	8,106	8,146	8,186
Collin	18,748	18,844	18,905	19,189	19,325	19,465	19,609	19,755	19,906	20,060	20,219
Dallas	97,398	97,875	98,174	98,473	98,978	99,492	100,016	100,549	101,093	101,646	102,209
Denton	14,978	15,059	15,139	15,272	15,387	15,504	15,624	15,746	15,871	15,999	16,129
El Paso	50,114	51,536	52,817	56,355	58,471	60,719	63,104	65,634	68,316	71,157	74,164
Ellis	5,072	5,101	5,130	5,146	5,173	5,200	5,228	5,257	5,287	5,317	5,348
Fort Bend	17,749	17,763	17,807	17,862	17,893	17,924	17,956	17,987	18,019	18,052	18,084
Galveston	12,703	12,745	12,787	12,857	12,914	12,975	13,038	13,104	13,174	13,247	13,324
Harris	162,306	163,287	163,845	164,445	165,025	165,611	166,203	166,802	167,407	168,019	168,637
Hidalgo	35,892	35,945	36,147	36,277	36,372	36,468	36,565	36,662	36,760	36,859	36,958
Johnson	3,848	3,876	3,903	3,926	3,959	3,992	4,027	4,063	4,100	4,138	4,177
Lubbock	19,418	19,751	20,328	20,788	21,141	21,503	21,877	22,260	22,655	23,061	23,478
McLennan	10,316	10,383	10,450	10,528	10,595	10,663	10,732	10,802	10,874	10,946	11,019
Montgomery	14,210	14,227	14,231	14,224	14,254	14,282	14,308	14,334	14,358	14,381	14,402
Tarrant	68,233	68,803	69,519	70,228	70,949	71,680	72,420	73,170	73,930	74,699	75,478
Travis	32,220	32,303	32,451	32,605	32,710	32,817	32,925	33,035	33,147	33,261	33,376
Williamson	9,639	9,664	9,708	9,755	9,790	9,826	9,863	9,900	9,938	9,977	10,016

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:		
	11/1	11/2	11/3	11/4	11/6	11/8	11/10
Bexar	66,064	66,231	66,529	66,714	67,137 (13,427) [3,223] {1,611}	67,564 (13,513) [3,243] {1,622}	67,995 (13,599) [3,264] {1,632}
Brazoria	12,594	12,687	12,703	12,718	12,799 (2,560) [614] {307}	12,882 (2,576) [618] {309}	12,968 (2,594) [622] {311}
Brazos	7,782	7,814	7,856	7,912	7,988 (1,598) [383] {192}	8,066 (1,613) [387] {194}	8,146 (1,629) [391] {196}
Collin	18,748	18,844	18,905	19,189	19,465 (3,893) [934] {467}	19,755 (3,951) [948] {474}	20,060 (4,012) [963] {481}
Dallas	97,398	97,875	98,174	98,473	99,492 (19,898) [4,776] {2,388}	100,549 (20,110) [4,826] {2,413}	101,646 (20,329) [4,879] {2,440}
Denton	14,978	15,059	15,139	15,272	15,504 (3,101) [744] {372}	15,746 (3,149) [756] {378}	15,999 (3,200) [768] {384}
El Paso	50,114	51,536	52,817	56,355	60,719 (12,144) [2,915] {1,457}	65,634 (13,127) [3,150] {1,575}	71,157 (14,231) [3,416] {1,708}
Ellis	5,072	5,101	5,130	5,146	5,200 (1,040) [250] {125}	5,257 (1,051) [252] {126}	5,317 (1,063) [255] {128}
Fort Bend	17,749	17,763	17,807	17,862	17,924 (3,585) [860] {430}	17,987 (3,597) [863] {432}	18,052 (3,610) [866] {433}
Galveston	12,703	12,745	12,787	12,857	12,975 (2,595) [623] {311}	13,104 (2,621) [629] {315}	13,247 (2,649) [636] {318}
Harris	162,306	163,287	163,845	164,445	165,611 (33,122) [7,949] {3,975}	166,802 (33,360) [8,006] {4,003}	168,019 (33,604) [8,065] {4,032}
Hidalgo	35,892	35,945	36,147	36,277	36,468 (7,294) [1,750] {875}	36,662 (7,332) [1,760] {880}	36,859 (7,372) [1,769] {885}
Johnson	3,848	3,876	3,903	3,926	3,992 (798) [192] {96}	4,063 (813) [195] {98}	4,138 (828) [199] {99}
Lubbock	19,418	19,751	20,328	20,788	21,503 (4,301) [1,032] {516}	22,260 (4,452) [1,068] {534}	23,061 (4,612) [1,107] {553}
McLennan	10,316	10,383	10,450	10,528	10,663 (2,133) [512] {256}	10,802 (2,160) [519] {259}	10,946 (2,189) [525] {263}
Montgomery	14,210	14,227	14,231	14,224	14,282 (2,856) [686] {343}	14,334 (2,867) [688] {344}	14,381 (2,876) [690] {345}
Tarrant	68,233	68,803	69,519	70,228	71,680 (14,336) [3,441] {1,720}	73,170 (14,634) [3,512] {1,756}	74,699 (14,940) [3,586] {1,793}
Travis	32,220	32,303	32,451	32,605	32,817 (6,563) [1,575] {788}	33,035 (6,607) [1,586] {793}	33,261 (6,652) [1,597] {798}
Williamson	9,639	9,664	9,708	9,755	9,826 (1,965) [472] {236}	9,900 (1,980) [475] {238}	9,977 (1,995) [479] {239}

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.