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

Date: 11/19/20

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 11/19/20 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.

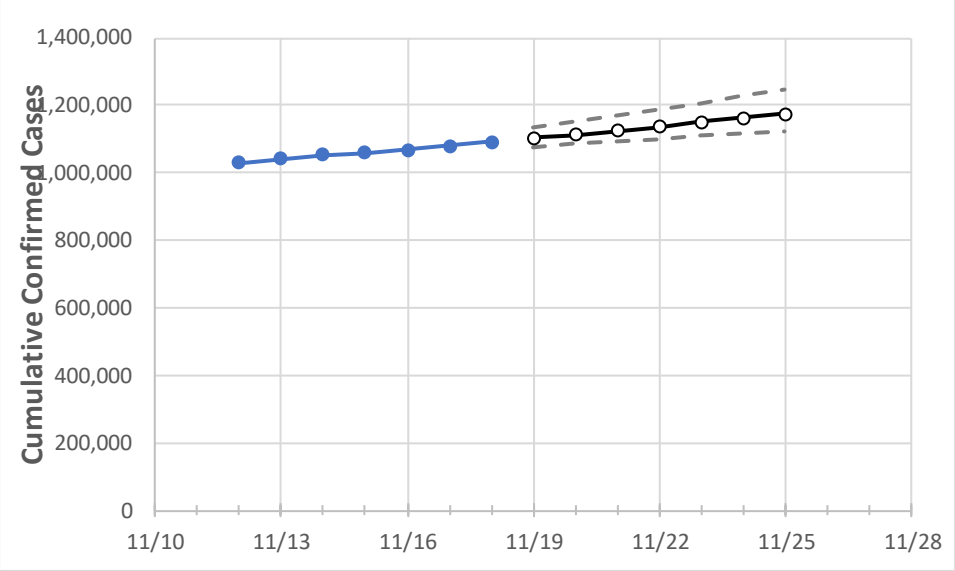
IEM's Modeling Lead

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:						
	11/15	11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23	11/24	11/25
Texas	1,059,753	1,066,918	1,078,875	1,091,558	1,102,609	1,113,963	1,125,628	1,137,611	1,149,922	1,162,567	1,175,555

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:						
	11/15	11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23	11/24	11/25
Bexar	70,042	70,236	70,528	70,894	71,261	71,639	72,030	72,433	72,848	73,277	73,719
Brazoria	13,308	13,336	13,364	13,455	13,513	13,573	13,635	13,699	13,765	13,834	13,904
Brazos	8,584	8,675	8,721	8,803	8,889	8,980	9,074	9,174	9,278	9,388	9,503
Collin	21,665	21,677	21,689	21,983	22,066	22,147	22,225	22,301	22,375	22,446	22,516
Dallas	109,022	110,098	111,174	111,960	113,007	114,093	115,221	116,392	117,607	118,867	120,175
Denton	17,022	17,157	17,347	17,553	17,721	17,893	18,072	18,255	18,445	18,640	18,842
El Paso	73,340	74,973	76,075	77,186	78,456	79,706	80,937	82,149	83,341	84,514	85,667
Ellis	5,733	5,751	5,770	5,831	5,871	5,911	5,952	5,994	6,035	6,078	6,121
Fort Bend	18,773	18,785	18,873	18,972	19,018	19,065	19,112	19,159	19,207	19,255	19,303
Galveston	13,570	13,633	13,696	13,760	13,825	13,892	13,960	14,030	14,101	14,174	14,249
Harris	174,493	175,414	175,959	177,466	178,595	179,768	180,987	182,253	183,568	184,935	186,354
Hidalgo	37,524	37,580	38,006	38,687	38,817	38,950	39,085	39,223	39,364	39,507	39,654
Johnson	4,436	4,472	4,509	4,584	4,639	4,698	4,760	4,825	4,894	4,968	5,045
Lubbock	25,038	25,810	26,145	26,693	27,098	27,510	27,927	28,351	28,780	29,215	29,656
McLennan	12,106	12,215	12,323	12,572	12,763	12,962	13,171	13,390	13,619	13,859	14,110
Montgomery	15,034	15,095	15,227	15,428	15,539	15,656	15,777	15,905	16,038	16,178	16,324
Tarrant	82,015	82,915	83,647	85,759	87,102	88,495	89,941	91,441	92,998	94,613	96,288
Travis	34,612	34,769	35,020	35,326	35,582	35,850	36,132	36,428	36,739	37,066	37,409
Williamson	10,958	11,016	11,084	11,184	11,290	11,402	11,520	11,646	11,778	11,918	12,066

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:		
	11/15	11/16	11/17	11/18	11/20	11/22	11/24
Bexar	70,042	70,236	70,528	70,894	71,639 (14,328) [3,439] {1,719}	72,433 (14,487) [3,477] {1,738}	73,277 (14,655) [3,517] {1,759}
Brazoria	13,308	13,336	13,364	13,455	13,573 (2,715) [652] {326}	13,699 (2,740) [658] {329}	13,834 (2,767) [664] {332}
Brazos	8,584	8,675	8,721	8,803	8,980 (1,796) [431] {216}	9,174 (1,835) [440] {220}	9,388 (1,878) [451] {225}
Collin	21,665	21,677	21,689	21,983	22,147 (4,429) [1,063] {532}	22,301 (4,460) [1,070] {535}	22,446 (4,489) [1,077] {539}
Dallas	109,022	110,098	111,174	111,960	114,093 (22,819) [5,476] {2,738}	116,392 (23,278) [5,587] {2,793}	118,867 (23,773) [5,706] {2,853}
Denton	17,022	17,157	17,347	17,553	17,893 (3,579) [859] {429}	18,255 (3,651) [876] {438}	18,640 (3,728) [895] {447}
El Paso	73,340	74,973	76,075	77,186	79,706 (15,941) [3,826] {1,913}	82,149 (16,430) [3,943] {1,972}	84,514 (16,903) [4,057] {2,028}
Ellis	5,733	5,751	5,770	5,831	5,911 (1,182) [284] {142}	5,994 (1,199) [288] {144}	6,078 (1,216) [292] {146}
Fort Bend	18,773	18,785	18,873	18,972	19,065 (3,813) [915] {458}	19,159 (3,832) [920] {460}	19,255 (3,851) [924] {462}
Galveston	13,570	13,633	13,696	13,760	13,892 (2,778) [667] {333}	14,030 (2,806) [673] {337}	14,174 (2,835) [680] {340}
Harris	174,493	175,414	175,959	177,466	179,768 (35,954) [8,629] {4,314}	182,253 (36,451) [8,748] {4,374}	184,935 (36,987) [8,877] {4,438}
Hidalgo	37,524	37,580	38,006	38,687	38,950 (7,790) [1,870] {935}	39,223 (7,845) [1,883] {941}	39,507 (7,901) [1,896] {948}
Johnson	4,436	4,472	4,509	4,584	4,698 (940) [225] {113}	4,825 (965) [232] {116}	4,968 (994) [238] {119}
Lubbock	25,038	25,810	26,145	26,693	27,510 (5,502) [1,320] {660}	28,351 (5,670) [1,361] {680}	29,215 (5,843) [1,402] {701}
McLennan	12,106	12,215	12,323	12,572	12,962 (2,592) [622] {311}	13,390 (2,678) [643] {321}	13,859 (2,772) [665] {333}
Montgomery	15,034	15,095	15,227	15,428	15,656 (3,131) [751] {376}	15,905 (3,181) [763] {382}	16,178 (3,236) [777] {388}
Tarrant	82,015	82,915	83,647	85,759	88,495 (17,699) [4,248] {2,124}	91,441 (18,288) [4,389] {2,195}	94,613 (18,923) [4,541] {2,271}
Travis	34,612	34,769	35,020	35,326	35,850 (7,170) [1,721] {860}	36,428 (7,286) [1,749] {874}	37,066 (7,413) [1,779] {890}
Williamson	10,958	11,016	11,084	11,184	11,402 (2,280) [547] {274}	11,646 (2,329) [559] {279}	11,918 (2,384) [572] {286}

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.