IEM's AI Modeling: Short-term COVID-19 Projections
Date: 11/30/20

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 <u>not</u> 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 11/30/20 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
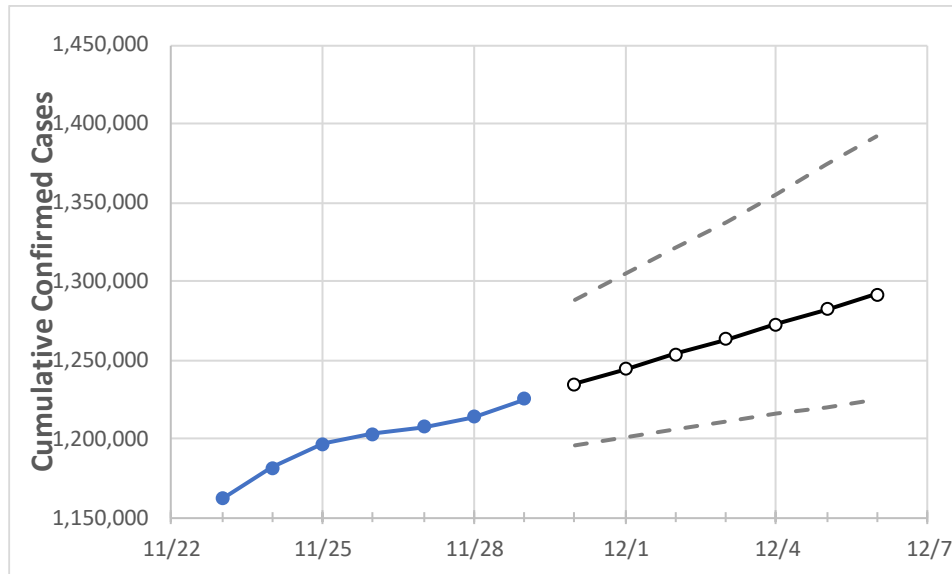
	Actual Confirmed Cases On:				Projected Cases For:						
	11/26	11/27	11/28	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6
Texas	1,202,804	1,207,243	1,213,577	1,225,118	1,234,627	1,244,133	1,253,636	1,263,136	1,272,633	1,282,125	1,291,615

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:						
	11/26	11/27	11/28	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6
Bexar	77,304	77,857	78,411	80,057	81,170	82,373	83,673	85,077	86,593	88,231	89,999
Brazoria	14,154	14,205	14,255	14,389	14,485	14,586	14,691	14,802	14,917	15,037	15,164
Brazos	10,951	10,974	10,998	11,021	11,064	11,106	11,146	11,185	11,222	11,258	11,292
Collin	24,882	25,153	25,566	26,192	26,466	26,757	27,065	27,392	27,738	28,105	28,493
Dallas	134,138	134,466	134,793	137,096	137,855	138,594	139,316	140,019	140,705	141,374	142,027
Denton	22,942	23,094	23,276	23,276	23,567	23,864	24,166	24,474	24,789	25,110	25,437
El Paso	83,993	84,683	85,318	85,696	86,172	86,619	87,040	87,436	87,808	88,157	88,486
Ellis	6,828	6,851	6,875	6,898	6,970	7,044	7,120	7,198	7,279	7,363	7,449
Fort Bend	20,132	20,286	20,440	20,440	20,669	20,920	21,195	21,497	21,828	22,191	22,589
Galveston	14,465	14,550	14,635	14,691	14,780	14,871	14,963	15,057	15,153	15,251	15,350
Harris	187,759	187,867	187,932	190,631	191,097	191,549	191,988	192,415	192,829	193,232	193,624
Hidalgo	42,538	42,844	42,844	42,844	43,230	43,642	44,085	44,558	45,066	45,610	46,193
Johnson	5,327	5,354	5,380	5,407	5,467	5,528	5,590	5,652	5,714	5,777	5,841
Lubbock	30,592	30,911	31,499	31,858	32,351	32,851	33,358	33,872	34,394	34,922	35,456
McLennan	14,029	14,029	14,029	14,029	14,196	14,365	14,538	14,713	14,892	15,074	15,259
Montgomery	16,982	16,982	16,982	16,982	17,306	17,661	18,051	18,479	18,949	19,465	20,032
Tarrant	96,315	96,642	96,968	97,294	97,851	98,385	98,895	99,384	99,851	100,299	100,727
Travis	37,452	37,666	37,898	38,045	38,280	38,516	38,754	38,994	39,236	39,479	39,724
Williamson	12,272	12,272	12,272	12,272	12,548	12,851	13,184	13,548	13,949	14,388	14,870

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:		
	11/26	11/27	11/28	11/29	12/1	12/3	12/5
Bexar	77,304	77,857	78,411	80,057	82,373 (16,475) [3,954] {1,977}	85,077 (17,015) [4,084] {2,042}	88,231 (17,646) [4,235] {2,118}
Brazoria	14,154	14,205	14,255	14,389	14,586 (2,917) [700] {350}	14,802 (2,960) [710] {355}	15,037 (3,007) [722] {361}
Brazos	10,951	10,974	10,998	11,021	11,106 (2,221) [533] {267}	11,185 (2,237) [537] {268}	11,258 (2,252) [540] {270}
Collin	24,882	25,153	25,566	26,192	26,757 (5,351) [1,284] {642}	27,392 (5,478) [1,315] {657}	28,105 (5,621) [1,349] {675}
Dallas	134,138	134,466	134,793	137,096	138,594 (27,719) [6,653] {3,326}	140,019 (28,004) [6,721] {3,360}	141,374 (28,275) [6,786] {3,393}
Denton	22,942	23,094	23,276	23,276	23,864 (4,773) [1,145] {573}	24,474 (4,895) [1,175] {587}	25,110 (5,022) [1,205] {603}
El Paso	83,993	84,683	85,318	85,696	86,619 (17,324) [4,158] {2,079}	87,436 (17,487) [4,197] {2,098}	88,157 (17,631) [4,232] {2,116}
Ellis	6,828	6,851	6,875	6,898	7,044 (1,409) [338] {169}	7,198 (1,440) [346] {173}	7,363 (1,473) [353] {177}
Fort Bend	20,132	20,286	20,440	20,440	20,920 (4,184) [1,004] {502}	21,497 (4,299) [1,032] {516}	22,191 (4,438) [1,065] {533}
Galveston	14,465	14,550	14,635	14,691	14,871 (2,974) [714] {357}	15,057 (3,011) [723] {361}	15,251 (3,050) [732] {366}
Harris	187,759	187,867	187,932	190,631	191,549 (38,310) [9,194] {4,597}	192,415 (38,483) [9,236] {4,618}	193,232 (38,646) [9,275] {4,638}
Hidalgo	42,538	42,844	42,844	42,844	43,642 (8,728) [2,095] {1,047}	44,558 (8,912) [2,139] {1,069}	45,610 (9,122) [2,189] {1,095}
Johnson	5,327	5,354	5,380	5,407	5,528 (1,106) [265] {133}	5,652 (1,130) [271] {136}	5,777 (1,155) [277] {139}
Lubbock	30,592	30,911	31,499	31,858	32,851 (6,570) [1,577] {788}	33,872 (6,774) [1,626] {813}	34,922 (6,984) [1,676] {838}
McLennan	14,029	14,029	14,029	14,029	14,365 (2,873) [690] {345}	14,713 (2,943) [706] {353}	15,074 (3,015) [724] {362}
Montgomery	16,982	16,982	16,982	16,982	17,661 (3,532) [848] {424}	18,479 (3,696) [887] {443}	19,465 (3,893) [934] {467}
Tarrant	96,315	96,642	96,968	97,294	98,385 (19,677) [4,722] {2,361}	99,384 (19,877) [4,770] {2,385}	100,299 (20,060) [4,814] {2,407}
Travis	37,452	37,666	37,898	38,045	38,516 (7,703) [1,849] {924}	38,994 (7,799) [1,872] {936}	39,479 (7,896) [1,895] {948}
Williamson	12,272	12,272	12,272	12,272	12,851 (2,570) [617] {308}	13,548 (2,710) [650] {325}	14,388 (2,878) [691] {345}

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.