IEM's AI Modeling: Short-term COVID-19 Projections
Date: 8/4/20

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 8/4/20 12 p.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
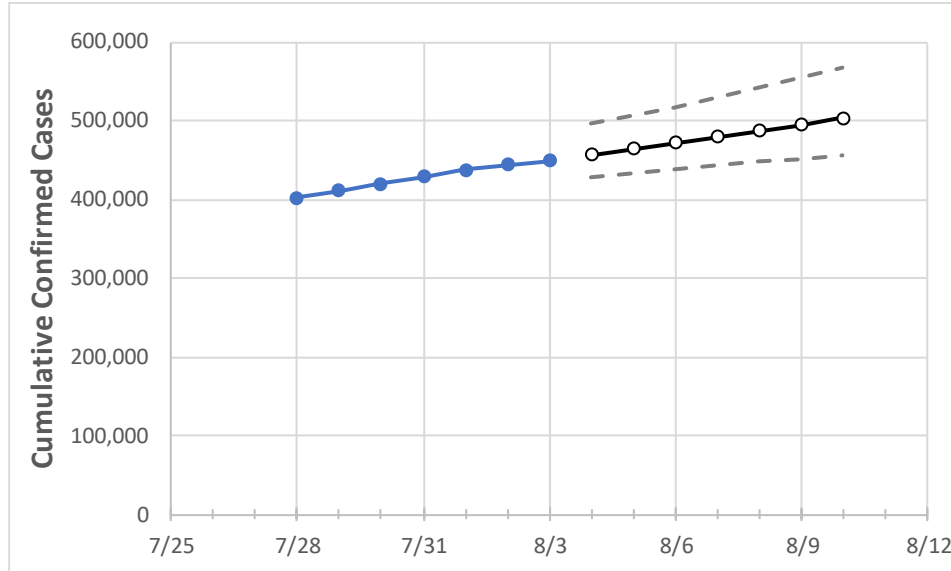
	Actual Confirmed Cases On:				Projected Cases For:						
	7/31	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10
Texas	428,223	437,688	443,360	449,032	456,640	464,276	471,942	479,636	487,357	495,104	502,876

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:						
	7/31	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10
Bexar	40,803	41,138	41,138	41,138	41,829	42,524	43,222	43,924	44,630	45,339	46,051
Brazoria	6,384	6,534	6,633	6,732	6,864	6,998	7,136	7,275	7,417	7,562	7,710
Brazos	3,850	3,877	3,900	3,922	3,946	3,969	3,992	4,014	4,036	4,057	4,077
Collin	6,253	6,353	6,378	6,403	6,444	6,484	6,523	6,561	6,597	6,633	6,667
Dallas	49,269	49,976	50,542	51,108	51,714	52,315	52,911	53,503	54,089	54,671	55,248
Denton	6,681	6,803	6,871	6,938	7,069	7,201	7,336	7,472	7,610	7,751	7,893
El Paso	14,276	14,410	14,662	14,914	15,120	15,326	15,532	15,738	15,943	16,149	16,354
Ellis	2,452	2,472	2,472	2,472	2,499	2,526	2,552	2,579	2,604	2,630	2,655
Fort Bend	6,960	7,082	7,137	7,191	7,266	7,343	7,421	7,501	7,581	7,663	7,747
Galveston	8,605	8,721	8,773	8,825	8,905	8,984	9,060	9,135	9,208	9,279	9,349
Harris	70,850	72,964	74,803	76,642	78,342	80,079	81,855	83,668	85,521	87,414	89,347
Hidalgo	16,646	17,006	17,180	17,353	17,657	17,966	18,281	18,600	18,925	19,255	19,590
Johnson	1,499	1,541	1,541	1,541	1,591	1,642	1,695	1,750	1,806	1,865	1,925
Lubbock	5,433	5,512	5,553	5,593	5,655	5,717	5,778	5,839	5,899	5,959	6,018
McLennan	4,263	4,326	4,381	4,436	4,495	4,553	4,612	4,671	4,730	4,790	4,849
Montgomery	6,077	6,196	6,196	6,196	6,309	6,424	6,541	6,662	6,785	6,911	7,039
Tarrant	27,823	28,410	28,732	29,054	29,534	30,019	30,508	31,001	31,498	32,000	32,506
Travis	20,465	20,745	20,980	21,214	21,398	21,578	21,755	21,928	22,098	22,265	22,429
Williamson	5,616	5,715	5,715	5,715	5,778	5,840	5,901	5,962	6,022	6,082	6,141

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:		
	7/31	8/1	8/2	8/3	8/5	8/7	8/9
Bexar	40,803	41,138	41,138	41,138	42,524 (8,505) [2,041] {1,021}	43,924 (8,785) [2,108] {1,054}	45,339 (9,068) [2,176] {1,088}
Brazoria	6,384	6,534	6,633	6,732	6,998 (1,400) [336] {168}	7,275 (1,455) [349] {175}	7,562 (1,512) [363] {181}
Brazos	3,850	3,877	3,900	3,922	3,969 (794) [191] {95}	4,014 (803) [193] {96}	4,057 (811) [195] {97}
Collin	6,253	6,353	6,378	6,403	6,484 (1,297) [311] {156}	6,561 (1,312) [315] {157}	6,633 (1,327) [318] {159}
Dallas	49,269	49,976	50,542	51,108	52,315 (10,463) [2,511] {1,256}	53,503 (10,701) [2,568] {1,284}	54,671 (10,934) [2,624] {1,312}
Denton	6,681	6,803	6,871	6,938	7,201 (1,440) [346] {173}	7,472 (1,494) [359] {179}	7,751 (1,550) [372] {186}
El Paso	14,276	14,410	14,662	14,914	15,326 (3,065) [736] {368}	15,738 (3,148) [755] {378}	16,149 (3,230) [775] {388}
Ellis	2,452	2,472	2,472	2,472	2,526 (505) [121] {61}	2,579 (516) [124] {62}	2,630 (526) [126] {63}
Fort Bend	6,960	7,082	7,137	7,191	7,343 (1,469) [352] {176}	7,501 (1,500) [360] {180}	7,663 (1,533) [368] {184}
Galveston	8,605	8,721	8,773	8,825	8,984 (1,797) [431] {216}	9,135 (1,827) [438] {219}	9,279 (1,856) [445] {223}
Harris	70,850	72,964	74,803	76,642	80,079 (16,016) [3,844] {1,922}	83,668 (16,734) [4,016] {2,008}	87,414 (17,483) [4,196] {2,098}
Hidalgo	16,646	17,006	17,180	17,353	17,966 (3,593) [862] {431}	18,600 (3,720) [893] {446}	19,255 (3,851) [924] {462}
Johnson	1,499	1,541	1,541	1,541	1,642 (328) [79] {39}	1,750 (350) [84] {42}	1,865 (373) [90] {45}
Lubbock	5,433	5,512	5,553	5,593	5,717 (1,143) [274] {137}	5,839 (1,168) [280] {140}	5,959 (1,192) [286] {143}
McLennan	4,263	4,326	4,381	4,436	4,553 (911) [219] {109}	4,671 (934) [224] {112}	4,790 (958) [230] {115}
Montgomery	6,077	6,196	6,196	6,196	6,424 (1,285) [308] {154}	6,662 (1,332) [320] {160}	6,911 (1,382) [332] {166}
Tarrant	27,823	28,410	28,732	29,054	30,019 (6,004) [1,441] {720}	31,001 (6,200) [1,488] {744}	32,000 (6,400) [1,536] {768}
Travis	20,465	20,745	20,980	21,214	21,578 (4,316) [1,036] {518}	21,928 (4,386) [1,053] {526}	22,265 (4,453) [1,069] {534}
Williamson	5,616	5,715	5,715	5,715	5,840 (1,168) [280] {140}	5,962 (1,192) [286] {143}	6,082 (1,216) [292] {146}

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.