IEM's AI Modeling: Short-term COVID-19 Projections
Date: 8/18/20

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

The projections shown in this document are based on data pulled in as of 8/18/20 1 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
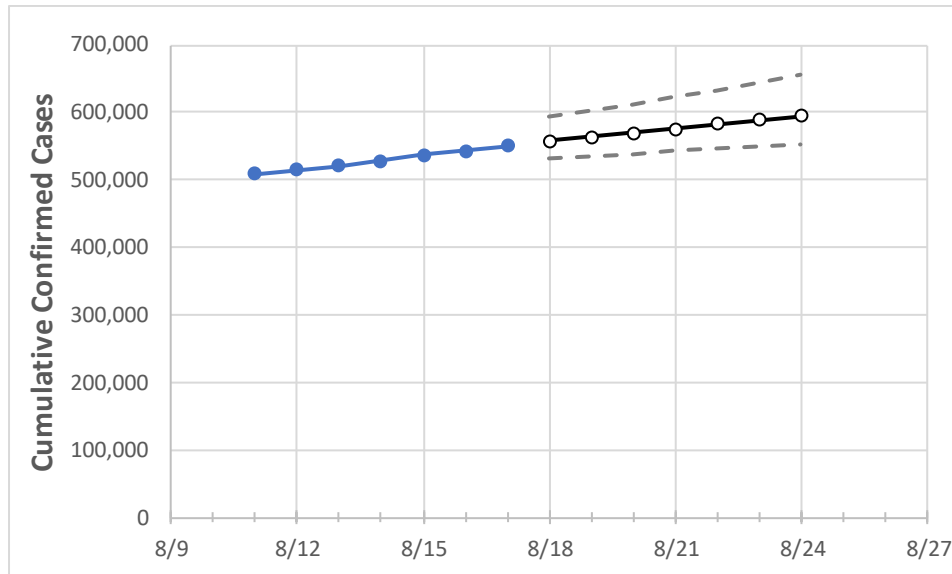
	Actual Confirmed Cases On:				Projected Cases For:						
	8/14	8/15	8/16	8/17	8/18	8/19	8/20	8/21	8/22	8/23	8/24
Texas	528,492	536,910	543,048	550,986	557,295	563,580	569,842	576,080	582,295	588,487	594,656

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:						
	8/14	8/15	8/16	8/17	8/18	8/19	8/20	8/21	8/22	8/23	8/24
Bexar	43,823	43,993	44,052	44,122	44,241	44,355	44,464	44,568	44,668	44,763	44,855
Brazoria	7,917	8,025	8,148	8,233	8,329	8,426	8,523	8,620	8,717	8,814	8,911
Brazos	4,147	4,158	4,173	4,185	4,198	4,210	4,222	4,233	4,244	4,255	4,266
Collin	8,445	9,612	10,007	10,006	10,329	10,678	11,057	11,467	11,912	12,393	12,915
Dallas	56,428	57,313	58,067	63,428	64,034	64,647	65,265	65,890	66,520	67,157	67,799
Denton	8,077	8,214	8,300	8,300	8,388	8,476	8,564	8,651	8,738	8,825	8,911
El Paso	17,632	18,079	18,350	18,486	18,705	18,925	19,147	19,371	19,597	19,825	20,054
Ellis	3,247	3,255	3,255	3,255	3,293	3,332	3,370	3,409	3,449	3,488	3,528
Fort Bend	10,823	11,369	12,228	12,228	12,754	13,129	13,534	13,899	14,288	14,666	15,074
Galveston	9,800	9,888	9,937	9,937	9,996	10,054	10,111	10,166	10,220	10,273	10,324
Harris	89,425	90,574	91,698	92,253	93,158	94,051	94,931	95,798	96,653	97,497	98,328
Hidalgo	21,275	21,806	21,910	22,013	22,223	22,430	22,635	22,838	23,040	23,239	23,435
Johnson	2,103	2,159	2,159	2,159	2,206	2,253	2,302	2,351	2,402	2,453	2,506
Lubbock	6,429	6,495	6,528	6,542	6,582	6,622	6,661	6,699	6,736	6,772	6,808
McLennan	5,248	5,296	5,322	5,356	5,400	5,443	5,486	5,529	5,571	5,613	5,655
Montgomery	6,864	6,957	6,957	6,957	6,997	7,037	7,076	7,114	7,152	7,188	7,224
Tarrant	33,403	33,874	35,310	35,997	36,388	36,781	37,178	37,577	37,978	38,383	38,790
Travis	23,718	23,870	24,008	24,144	24,302	24,457	24,611	24,763	24,914	25,062	25,209
Williamson	7,148	7,330	7,330	7,330	7,459	7,594	7,733	7,877	8,027	8,182	8,343

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:		
	8/14	8/15	8/16	8/17	8/19	8/21	8/23
Bexar	43,823	43,993	44,052	44,122	44,355 (8,871) [2,129] {1,065}	44,568 (8,914) [2,139] {1,070}	44,763 (8,953) [2,149] {1,074}
Brazoria	7,917	8,025	8,148	8,233	8,426 (1,685) [404] {202}	8,620 (1,724) [414] {207}	8,814 (1,763) [423] {212}
Brazos	4,147	4,158	4,173	4,185	4,210 (842) [202] {101}	4,233 (847) [203] {102}	4,255 (851) [204] {102}
Collin	8,445	9,612	10,007	10,006	10,678 (2,136) [513] {256}	11,467 (2,293) [550] {275}	12,393 (2,479) [595] {297}
Dallas	56,428	57,313	58,067	63,428	64,647 (12,929) [3,103] {1,552}	65,890 (13,178) [3,163] {1,581}	67,157 (13,431) [3,224] {1,612}
Denton	8,077	8,214	8,300	8,300	8,476 (1,695) [407] {203}	8,651 (1,730) [415] {208}	8,825 (1,765) [424] {212}
El Paso	17,632	18,079	18,350	18,486	18,925 (3,785) [908] {454}	19,371 (3,874) [930] {465}	19,825 (3,965) [952] {476}
Ellis	3,247	3,255	3,255	3,255	3,332 (666) [160] {80}	3,409 (682) [164] {82}	3,488 (698) [167] {84}
Fort Bend	10,823	11,369	12,228	12,228	13,129 (2,626) [630] {315}	13,899 (2,780) [667] {334}	14,666 (2,933) [704] {352}
Galveston	9,800	9,888	9,937	9,937	10,054 (2,011) [483] {241}	10,166 (2,033) [488] {244}	10,273 (2,055) [493] {247}
Harris	89,425	90,574	91,698	92,253	94,051 (18,810) [4,514] {2,257}	95,798 (19,160) [4,598] {2,299}	97,497 (19,499) [4,680] {2,340}
Hidalgo	21,275	21,806	21,910	22,013	22,430 (4,486) [1,077] {538}	22,838 (4,568) [1,096] {548}	23,239 (4,648) [1,115] {558}
Johnson	2,103	2,159	2,159	2,159	2,253 (451) [108] {54}	2,351 (470) [113] {56}	2,453 (491) [118] {59}
Lubbock	6,429	6,495	6,528	6,542	6,622 (1,324) [318] {159}	6,699 (1,340) [322] {161}	6,772 (1,354) [325] {163}
McLennan	5,248	5,296	5,322	5,356	5,443 (1,089) [261] {131}	5,529 (1,106) [265] {133}	5,613 (1,123) [269] {135}
Montgomery	6,864	6,957	6,957	6,957	7,037 (1,407) [338] {169}	7,114 (1,423) [341] {171}	7,188 (1,438) [345] {173}
Tarrant	33,403	33,874	35,310	35,997	36,781 (7,356) [1,765] {883}	37,577 (7,515) [1,804] {902}	38,383 (7,677) [1,842] {921}
Travis	23,718	23,870	24,008	24,144	24,457 (4,891) [1,174] {587}	24,763 (4,953) [1,189] {594}	25,062 (5,012) [1,203] {601}
Williamson	7,148	7,330	7,330	7,330	7,594 (1,519) [364] {182}	7,877 (1,575) [378] {189}	8,182 (1,636) [393] {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.