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

Date: 8/19/20

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

The projections shown in this document are based on data pulled in as of 8/19/20 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.

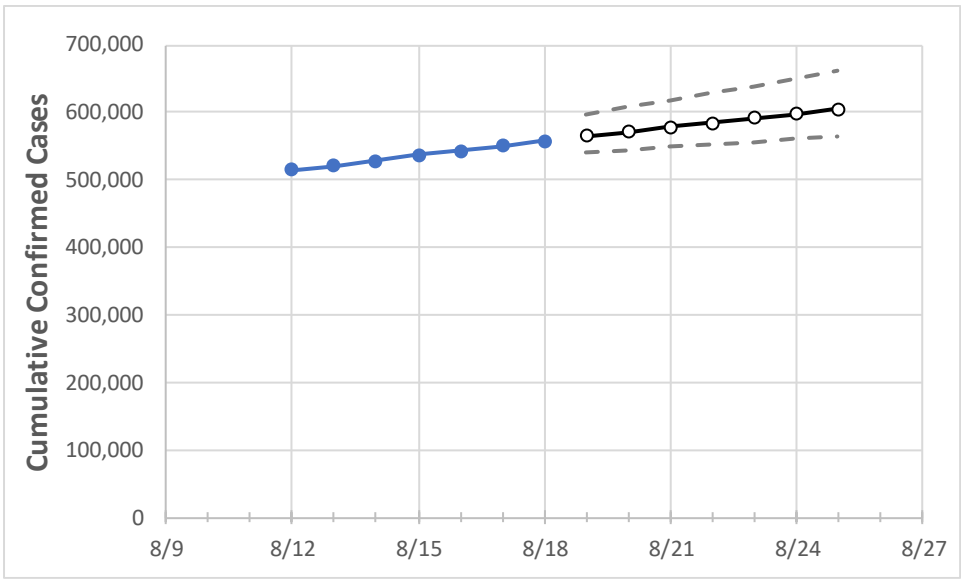
IEM's Modeling Lead

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:						
	8/15	8/16	8/17	8/18	8/19	8/20	8/21	8/22	8/23	8/24	8/25
Texas	536,909	543,046	550,984	558,366	565,031	571,699	578,371	585,045	591,721	598,397	605,073

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:						
	8/15	8/16	8/17	8/18	8/19	8/20	8/21	8/22	8/23	8/24	8/25
Bexar	43,993	44,052	44,122	44,265	44,383	44,496	44,604	44,706	44,804	44,898	44,987
Brazoria	8,025	8,148	8,233	8,303	8,398	8,493	8,589	8,684	8,779	8,874	8,969
Brazos	4,158	4,173	4,185	4,192	4,204	4,215	4,227	4,237	4,248	4,258	4,268
Collin	9,612	10,007	10,006	10,169	10,511	10,881	11,280	11,711	12,177	12,680	13,223
Dallas	57,313	58,067	63,428	65,278	65,998	66,732	67,480	68,242	69,018	69,808	70,614
Denton	8,214	8,300	8,364	8,427	8,507	8,586	8,665	8,743	8,820	8,897	8,974
El Paso	18,079	18,350	18,486	18,682	18,903	19,126	19,350	19,576	19,804	20,033	20,264
Ellis	3,255	3,314	3,374	3,433	3,479	3,526	3,573	3,621	3,671	3,721	3,771
Fort Bend	11,369	12,228	12,426	12,623	13,059	13,528	14,035	14,580	15,168	15,802	16,484
Galveston	9,888	9,937	9,985	10,033	10,085	10,136	10,185	10,232	10,279	10,324	10,367
Harris	90,574	91,698	92,253	92,944	93,768	94,576	95,370	96,149	96,913	97,663	98,398
Hidalgo	21,806	21,910	22,013	22,013	22,223	22,431	22,638	22,843	23,047	23,249	23,449
Johnson	2,159	2,213	2,266	2,320	2,369	2,420	2,471	2,524	2,578	2,632	2,688
Lubbock	6,495	6,528	6,542	6,542	6,583	6,623	6,662	6,701	6,739	6,776	6,813
McLennan	5,296	5,322	5,356	5,372	5,407	5,441	5,474	5,507	5,539	5,570	5,601
Montgomery	6,957	7,025	7,092	7,160	7,203	7,245	7,287	7,328	7,368	7,407	7,446
Tarrant	33,874	35,310	35,997	36,239	36,610	36,984	37,358	37,735	38,112	38,492	38,873
Travis	23,870	24,008	24,144	24,409	24,572	24,734	24,895	25,054	25,212	25,369	25,524
Williamson	7,330	7,381	7,431	7,482	7,572	7,664	7,757	7,852	7,948	8,045	8,144

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:		
	8/15	8/16	8/17	8/18	8/20	8/22	8/24
Bexar	43,993	44,052	44,122	44,265	44,496 (8,899) [2,136] {1,068}	44,706 (8,941) [2,146] {1,073}	44,898 (8,980) [2,155] {1,078}
Brazoria	8,025	8,148	8,233	8,303	8,493 (1,699) [408] {204}	8,684 (1,737) [417] {208}	8,874 (1,775) [426] {213}
Brazos	4,158	4,173	4,185	4,192	4,215 (843) [202] {101}	4,237 (847) [203] {102}	4,258 (852) [204] {102}
Collin	9,612	10,007	10,006	10,169	10,881 (2,176) [522] {261}	11,711 (2,342) [562] {281}	12,680 (2,536) [609] {304}
Dallas	57,313	58,067	63,428	65,278	66,732 (13,346) [3,203] {1,602}	68,242 (13,648) [3,276] {1,638}	69,808 (13,962) [3,351] {1,675}
Denton	8,214	8,300	8,364	8,427	8,586 (1,717) [412] {206}	8,743 (1,749) [420] {210}	8,897 (1,779) [427] {214}
El Paso	18,079	18,350	18,486	18,682	19,126 (3,825) [918] {459}	19,576 (3,915) [940] {470}	20,033 (4,007) [962] {481}
Ellis	3,255	3,314	3,374	3,433	3,526 (705) [169] {85}	3,621 (724) [174] {87}	3,721 (744) [179] {89}
Fort Bend	11,369	12,228	12,426	12,623	13,528 (2,706) [649] {325}	14,580 (2,916) [700] {350}	15,802 (3,160) [758] {379}
Galveston	9,888	9,937	9,985	10,033	10,136 (2,027) [487] {243}	10,232 (2,046) [491] {246}	10,324 (2,065) [496] {248}
Harris	90,574	91,698	92,253	92,944	94,576 (18,915) [4,540] {2,270}	96,149 (19,230) [4,615] {2,308}	97,663 (19,533) [4,688] {2,344}
Hidalgo	21,806	21,910	22,013	22,013	22,431 (4,486) [1,077] {538}	22,843 (4,569) [1,096] {548}	23,249 (4,650) [1,116] {558}
Johnson	2,159	2,213	2,266	2,320	2,420 (484) [116] {58}	2,524 (505) [121] {61}	2,632 (526) [126] {63}
Lubbock	6,495	6,528	6,542	6,542	6,623 (1,325) [318] {159}	6,701 (1,340) [322] {161}	6,776 (1,355) [325] {163}
McLennan	5,296	5,322	5,356	5,372	5,441 (1,088) [261] {131}	5,507 (1,101) [264] {132}	5,570 (1,114) [267] {134}
Montgomery	6,957	7,025	7,092	7,160	7,245 (1,449) [348] {174}	7,328 (1,466) [352] {176}	7,407 (1,481) [356] {178}
Tarrant	33,874	35,310	35,997	36,239	36,984 (7,397) [1,775] {888}	37,735 (7,547) [1,811] {906}	38,492 (7,698) [1,848] {924}
Travis	23,870	24,008	24,144	24,409	24,734 (4,947) [1,187] {594}	25,054 (5,011) [1,203] {601}	25,369 (5,074) [1,218] {609}
Williamson	7,330	7,381	7,431	7,482	7,664 (1,533) [368] {184}	7,852 (1,570) [377] {188}	8,045 (1,609) [386] {193}

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.