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

Date: 10/2/20

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 10/2/20 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.

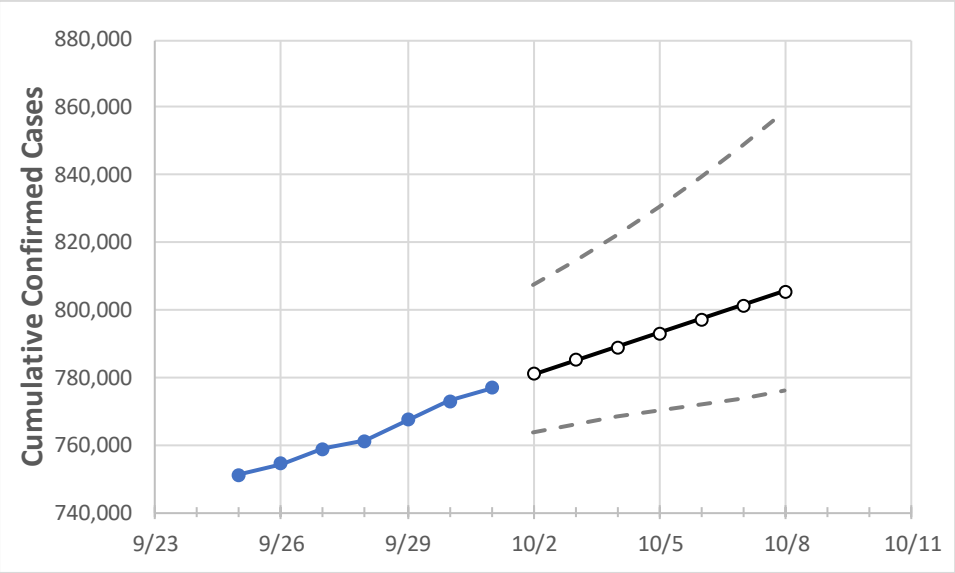
IEM's Modeling Lead

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:						
	9/28	9/29	9/30	10/1	10/2	10/3	10/4	10/5	10/6	10/7	10/8
Texas	761,198	767,264	773,019	776,736	780,854	784,967	789,075	793,176	797,272	801,363	805,447

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:						
	9/28	9/29	9/30	10/1	10/2	10/3	10/4	10/5	10/6	10/7	10/8
Bexar	57,208	57,677	57,832	57,936	58,166	58,402	58,642	58,887	59,138	59,394	59,656
Brazoria	11,395	11,412	11,440	11,485	11,516	11,545	11,574	11,602	11,629	11,654	11,679
Brazos	6,402	6,453	6,492	6,536	6,568	6,600	6,631	6,661	6,691	6,720	6,748
Collin	13,770	13,825	13,922	14,109	14,194	14,280	14,366	14,453	14,540	14,627	14,715
Dallas	81,372	82,161	82,410	82,410	82,889	83,383	83,893	84,420	84,964	85,525	86,104
Denton	12,058	12,148	12,242	12,319	12,380	12,441	12,501	12,562	12,623	12,683	12,744
El Paso	23,905	24,170	24,446	24,666	24,923	25,192	25,475	25,771	26,082	26,409	26,751
Ellis	4,433	4,450	4,451	4,459	4,468	4,477	4,485	4,493	4,500	4,508	4,515
Fort Bend	16,295	16,387	16,472	16,494	16,542	16,590	16,640	16,690	16,741	16,794	16,847
Galveston	11,620	11,636	11,670	11,697	11,718	11,739	11,760	11,781	11,802	11,823	11,844
Harris	141,707	142,315	142,681	143,530	144,011	144,472	144,915	145,339	145,746	146,136	146,509
Hidalgo	31,677	31,835	31,984	32,198	32,281	32,361	32,441	32,518	32,594	32,669	32,741
Johnson	3,072	3,102	3,113	3,130	3,159	3,190	3,221	3,252	3,285	3,319	3,353
Lubbock	11,422	11,764	11,952	12,139	12,308	12,482	12,662	12,849	13,041	13,239	13,444
McLennan	8,000	8,061	8,122	8,179	8,234	8,289	8,344	8,400	8,456	8,512	8,568
Montgomery	10,912	10,996	11,092	11,221	11,255	11,288	11,320	11,351	11,381	11,410	11,438
Tarrant	49,703	50,060	50,417	50,729	51,094	51,462	51,832	52,205	52,581	52,961	53,343
Travis	29,343	29,421	29,514	29,576	29,652	29,728	29,804	29,881	29,957	30,034	30,112
Williamson	8,624	8,642	8,663	8,672	8,690	8,707	8,724	8,741	8,757	8,773	8,789

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:		
	9/28	9/29	9/30	10/1	10/3	10/5	10/7
Bexar	57,208	57,677	57,832	57,936	58,402 (11,680) [2,803] {1,402}	58,887 (11,777) [2,827] {1,413}	59,394 (11,879) [2,851] {1,425}
Brazoria	11,395	11,412	11,440	11,485	11,545 (2,309) [554] {277}	11,602 (2,320) [557] {278}	11,654 (2,331) [559] {280}
Brazos	6,402	6,453	6,492	6,536	6,600 (1,320) [317] {158}	6,661 (1,332) [320] {160}	6,720 (1,344) [323] {161}
Collin	13,770	13,825	13,922	14,109	14,280 (2,856) [685] {343}	14,453 (2,891) [694] {347}	14,627 (2,925) [702] {351}
Dallas	81,372	82,161	82,410	82,410	83,383 (16,677) [4,002] {2,001}	84,420 (16,884) [4,052] {2,026}	85,525 (17,105) [4,105] {2,053}
Denton	12,058	12,148	12,242	12,319	12,441 (2,488) [597] {299}	12,562 (2,512) [603] {301}	12,683 (2,537) [609] {304}
El Paso	23,905	24,170	24,446	24,666	25,192 (5,038) [1,209] {605}	25,771 (5,154) [1,237] {619}	26,409 (5,282) [1,268] {634}
Ellis	4,433	4,450	4,451	4,459	4,477 (895) [215] {107}	4,493 (899) [216] {108}	4,508 (902) [216] {108}
Fort Bend	16,295	16,387	16,472	16,494	16,590 (3,318) [796] {398}	16,690 (3,338) [801] {401}	16,794 (3,359) [806] {403}
Galveston	11,620	11,636	11,670	11,697	11,739 (2,348) [563] {282}	11,781 (2,356) [565] {283}	11,823 (2,365) [568] {284}
Harris	141,707	142,315	142,681	143,530	144,472 (28,894) [6,935] {3,467}	145,339 (29,068) [6,976] {3,488}	146,136 (29,227) [7,015] {3,507}
Hidalgo	31,677	31,835	31,984	32,198	32,361 (6,472) [1,553] {777}	32,518 (6,504) [1,561] {780}	32,669 (6,534) [1,568] {784}
Johnson	3,072	3,102	3,113	3,130	3,190 (638) [153] {77}	3,252 (650) [156] {78}	3,319 (664) [159] {80}
Lubbock	11,422	11,764	11,952	12,139	12,482 (2,496) [599] {300}	12,849 (2,570) [617] {308}	13,239 (2,648) [635] {318}
McLennan	8,000	8,061	8,122	8,179	8,289 (1,658) [398] {199}	8,400 (1,680) [403] {202}	8,512 (1,702) [409] {204}
Montgomery	10,912	10,996	11,092	11,221	11,288 (2,258) [542] {271}	11,351 (2,270) [545] {272}	11,410 (2,282) [548] {274}
Tarrant	49,703	50,060	50,417	50,729	51,462 (10,292) [2,470] {1,235}	52,205 (10,441) [2,506] {1,253}	52,961 (10,592) [2,542] {1,271}
Travis	29,343	29,421	29,514	29,576	29,728 (5,946) [1,427] {713}	29,881 (5,976) [1,434] {717}	30,034 (6,007) [1,442] {721}
Williamson	8,624	8,642	8,663	8,672	8,707 (1,741) [418] {209}	8,741 (1,748) [420] {210}	8,773 (1,755) [421] {211}

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.