IEM's AI Modeling: Short-term COVID-19 Projections
Date: 9/11/20

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 9/11/20 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
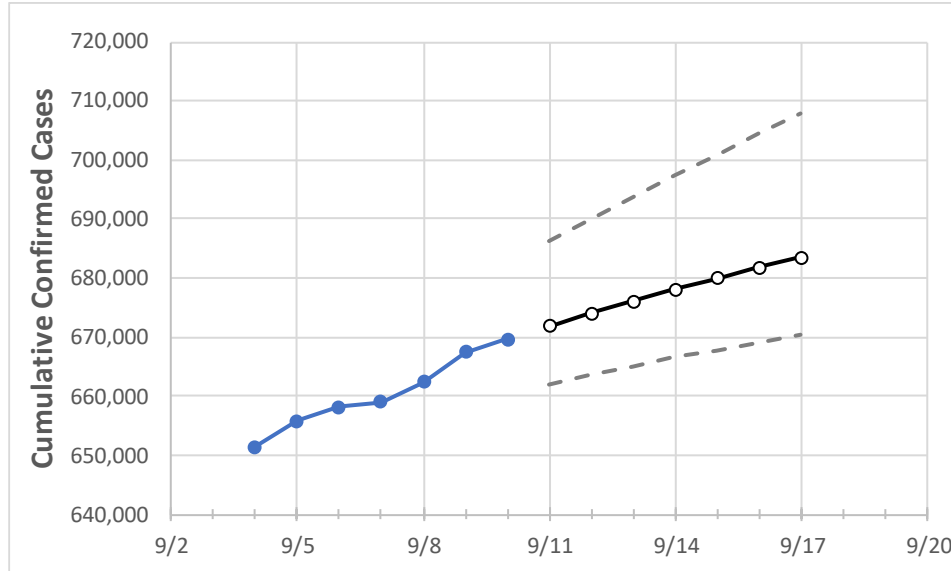
	Actual Confirmed Cases On:				Projected Cases For:						
	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16	9/17
Texas	659,041	662,427	667,500	669,592	671,868	674,040	676,114	678,094	679,983	681,786	683,507

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:						
	9/7	9/8	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16	9/17
Bexar	47,640	47,736	47,887	47,956	48,066	48,173	48,278	48,381	48,482	48,580	48,676
Brazoria	9,882	9,924	10,004	10,004	10,109	10,216	10,326	10,438	10,553	10,670	10,791
Brazos	5,359	5,442	5,506	5,569	5,672	5,782	5,898	6,022	6,153	6,293	6,440
Collin	11,534	11,632	11,676	11,676	11,753	11,833	11,916	12,001	12,089	12,180	12,274
Dallas	73,900	74,100	74,476	74,628	74,830	75,025	75,211	75,391	75,564	75,730	75,889
Denton	10,639	10,766	10,847	10,916	10,967	11,016	11,062	11,107	11,150	11,192	11,231
El Paso	21,093	21,187	21,259	21,259	21,328	21,394	21,458	21,519	21,579	21,635	21,690
Ellis	3,920	3,935	3,951	3,951	3,964	3,976	3,988	3,999	4,010	4,020	4,030
Fort Bend	15,153	15,158	15,249	15,331	15,353	15,373	15,393	15,412	15,429	15,446	15,462
Galveston	10,941	11,007	11,101	11,177	11,228	11,281	11,334	11,389	11,445	11,503	11,562
Harris	111,782	112,039	112,762	113,504	113,995	114,468	114,923	115,362	115,785	116,192	116,584
Hidalgo	28,732	28,893	29,082	29,082	29,183	29,280	29,373	29,462	29,547	29,628	29,706
Johnson	2,601	2,608	2,615	2,615	2,622	2,628	2,634	2,639	2,644	2,649	2,654
Lubbock	8,912	8,983	9,075	9,075	9,266	9,414	9,573	9,708	9,853	10,012	10,150
McLennan	6,726	6,766	6,813	6,813	6,855	6,896	6,936	6,975	7,013	7,051	7,087
Montgomery	9,324	9,377	9,466	9,586	9,650	9,713	9,776	9,839	9,901	9,963	10,024
Tarrant	42,969	43,055	43,515	43,726	43,864	43,997	44,125	44,248	44,367	44,481	44,590
Travis	27,038	27,124	27,206	27,424	27,480	27,535	27,588	27,640	27,690	27,739	27,787
Williamson	8,075	8,092	8,107	8,125	8,138	8,150	8,162	8,173	8,184	8,194	8,204

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:		
	9/7	9/8	9/9	9/10	9/12	9/14	9/16
Bexar	47,640	47,736	47,887	47,956	48,173 (9,635) [2,312] {1,156}	48,381 (9,676) [2,322] {1,161}	48,580 (9,716) [2,332] {1,166}
Brazoria	9,882	9,924	10,004	10,004	10,216 (2,043) [490] {245}	10,438 (2,088) [501] {251}	10,670 (2,134) [512] {256}
Brazos	5,359	5,442	5,506	5,569	5,782 (1,156) [278] {139}	6,022 (1,204) [289] {145}	6,293 (1,259) [302] {151}
Collin	11,534	11,632	11,676	11,676	11,833 (2,367) [568] {284}	12,001 (2,400) [576] {288}	12,180 (2,436) [585] {292}
Dallas	73,900	74,100	74,476	74,628	75,025 (15,005) [3,601] {1,801}	75,391 (15,078) [3,619] {1,809}	75,730 (15,146) [3,635] {1,818}
Denton	10,639	10,766	10,847	10,916	11,016 (2,203) [529] {264}	11,107 (2,221) [533] {267}	11,192 (2,238) [537] {269}
El Paso	21,093	21,187	21,259	21,259	21,394 (4,279) [1,027] {513}	21,519 (4,304) [1,033] {516}	21,635 (4,327) [1,039] {519}
Ellis	3,920	3,935	3,951	3,951	3,976 (795) [191] {95}	3,999 (800) [192] {96}	4,020 (804) [193] {96}
Fort Bend	15,153	15,158	15,249	15,331	15,373 (3,075) [738] {369}	15,412 (3,082) [740] {370}	15,446 (3,089) [741] {371}
Galveston	10,941	11,007	11,101	11,177	11,281 (2,256) [541] {271}	11,389 (2,278) [547] {273}	11,503 (2,301) [552] {276}
Harris	111,782	112,039	112,762	113,504	114,468 (22,894) [5,494] {2,747}	115,362 (23,072) [5,537] {2,769}	116,192 (23,238) [5,577] {2,789}
Hidalgo	28,732	28,893	29,082	29,082	29,280 (5,856) [1,405] {703}	29,462 (5,892) [1,414] {707}	29,628 (5,926) [1,422] {711}
Johnson	2,601	2,608	2,615	2,615	2,628 (526) [126] {63}	2,639 (528) [127] {63}	2,649 (530) [127] {64}
Lubbock	8,912	8,983	9,075	9,075	9,414 (1,883) [452] {226}	9,708 (1,942) [466] {233}	10,012 (2,002) [481] {240}
McLennan	6,726	6,766	6,813	6,813	6,896 (1,379) [331] {166}	6,975 (1,395) [335] {167}	7,051 (1,410) [338] {169}
Montgomery	9,324	9,377	9,466	9,586	9,713 (1,943) [466] {233}	9,839 (1,968) [472] {236}	9,963 (1,993) [478] {239}
Tarrant	42,969	43,055	43,515	43,726	43,997 (8,799) [2,112] {1,056}	44,248 (8,850) [2,124] {1,062}	44,481 (8,896) [2,135] {1,068}
Travis	27,038	27,124	27,206	27,424	27,535 (5,507) [1,322] {661}	27,640 (5,528) [1,327] {663}	27,739 (5,548) [1,331] {666}
Williamson	8,075	8,092	8,107	8,125	8,150 (1,630) [391] {196}	8,173 (1,635) [392] {196}	8,194 (1,639) [393] {197}

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.