IEM's AI Modeling: Short-term COVID-19 Projections
Date: 11/4/20

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 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 11/4/20 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
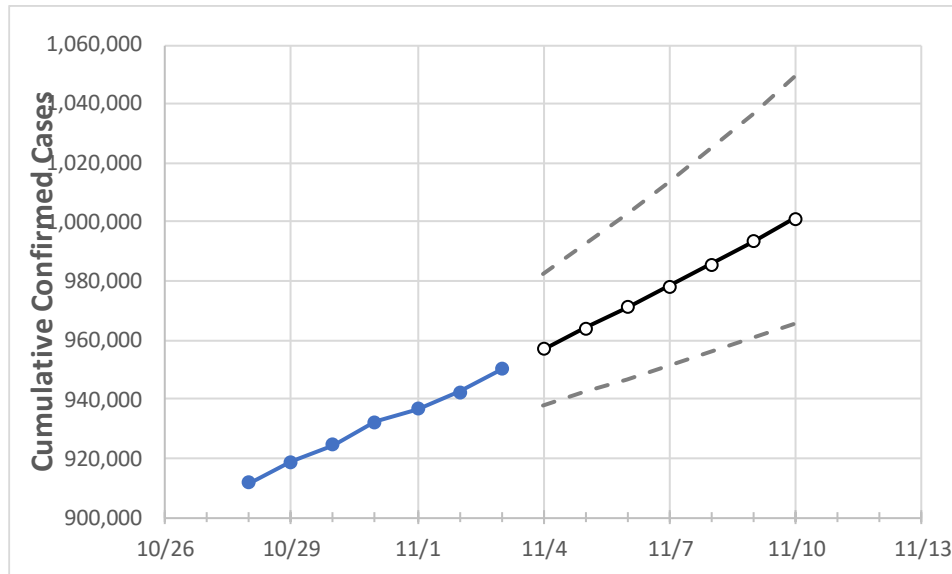
	Actual Confirmed Cases On:				Projected Cases For:						
	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7	11/8	11/9	11/10
Texas	932,261	936,816	942,303	950,302	957,093	964,033	971,125	978,373	985,780	993,349	#######

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:						
	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7	11/8	11/9	11/10
Bexar	65,873	66,064	66,231	66,529	66,745	66,962	67,181	67,401	67,623	67,846	68,071
Brazoria	12,501	12,594	12,687	12,687	12,755	12,827	12,902	12,981	13,065	13,153	13,246
Brazos	7,756	7,782	7,814	7,856	7,892	7,928	7,965	8,002	8,039	8,076	8,114
Collin	18,635	18,748	18,844	18,905	19,030	19,158	19,288	19,422	19,558	19,698	19,840
Dallas	96,694	97,398	97,875	97,875	98,452	99,045	99,656	100,284	100,930	101,594	102,278
Denton	14,884	14,978	15,059	15,139	15,249	15,360	15,475	15,591	15,710	15,832	15,956
El Paso	48,885	50,114	51,536	52,817	54,676	56,638	58,708	60,892	63,193	65,618	68,172
Ellis	5,043	5,072	5,101	5,130	5,156	5,183	5,210	5,239	5,268	5,297	5,328
Fort Bend	17,735	17,749	17,763	17,807	17,840	17,874	17,908	17,942	17,976	18,011	18,046
Galveston	12,663	12,703	12,745	12,787	12,841	12,897	12,955	13,017	13,081	13,149	13,219
Harris	161,613	162,306	163,287	163,845	164,433	165,028	165,629	166,237	166,852	167,473	168,102
Hidalgo	35,838	35,892	35,945	36,147	36,237	36,326	36,413	36,498	36,582	36,665	36,746
Johnson	3,821	3,848	3,876	3,903	3,937	3,972	4,009	4,047	4,086	4,127	4,170
Lubbock	19,167	19,418	19,751	20,328	20,664	21,009	21,363	21,727	22,102	22,486	22,880
McLennan	10,263	10,316	10,383	10,450	10,515	10,580	10,647	10,714	10,782	10,851	10,921
Montgomery	14,192	14,210	14,227	14,231	14,263	14,293	14,322	14,349	14,375	14,399	14,422
Tarrant	67,484	68,233	68,803	69,519	70,237	70,965	71,703	72,453	73,213	73,984	74,766
Travis	32,143	32,220	32,303	32,451	32,549	32,649	32,750	32,852	32,956	33,061	33,167
Williamson	9,613	9,639	9,664	9,708	9,742	9,776	9,811	9,846	9,882	9,918	9,955

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:		
	10/31	11/1	11/2	11/3	11/5	11/7	11/9
Bexar	65,873	66,064	66,231	66,529	66,962 (13,392) [3,214] {1,607}	67,401 (13,480) [3,235] {1,618}	67,846 (13,569) [3,257] {1,628}
Brazoria	12,501	12,594	12,687	12,687	12,827 (2,565) [616] {308}	12,981 (2,596) [623] {312}	13,153 (2,631) [631] {316}
Brazos	7,756	7,782	7,814	7,856	7,928 (1,586) [381] {190}	8,002 (1,600) [384] {192}	8,076 (1,615) [388] {194}
Collin	18,635	18,748	18,844	18,905	19,158 (3,832) [920] {460}	19,422 (3,884) [932] {466}	19,698 (3,940) [945] {473}
Dallas	96,694	97,398	97,875	97,875	99,045 (19,809) [4,754] {2,377}	100,284 (20,057) [4,814] {2,407}	101,594 (20,319) [4,877] {2,438}
Denton	14,884	14,978	15,059	15,139	15,360 (3,072) [737] {369}	15,591 (3,118) [748] {374}	15,832 (3,166) [760] {380}
El Paso	48,885	50,114	51,536	52,817	56,638 (11,328) [2,719] {1,359}	60,892 (12,178) [2,923] {1,461}	65,618 (13,124) [3,150] {1,575}
Ellis	5,043	5,072	5,101	5,130	5,183 (1,037) [249] {124}	5,239 (1,048) [251] {126}	5,297 (1,059) [254] {127}
Fort Bend	17,735	17,749	17,763	17,807	17,874 (3,575) [858] {429}	17,942 (3,588) [861] {431}	18,011 (3,602) [865] {432}
Galveston	12,663	12,703	12,745	12,787	12,897 (2,579) [619] {310}	13,017 (2,603) [625] {312}	13,149 (2,630) [631] {316}
Harris	161,613	162,306	163,287	163,845	165,028 (33,006) [7,921] {3,961}	166,237 (33,247) [7,979] {3,990}	167,473 (33,495) [8,039] {4,019}
Hidalgo	35,838	35,892	35,945	36,147	36,326 (7,265) [1,744] {872}	36,498 (7,300) [1,752] {876}	36,665 (7,333) [1,760] {880}
Johnson	3,821	3,848	3,876	3,903	3,972 (794) [191] {95}	4,047 (809) [194] {97}	4,127 (825) [198] {99}
Lubbock	19,167	19,418	19,751	20,328	21,009 (4,202) [1,008] {504}	21,727 (4,345) [1,043] {521}	22,486 (4,497) [1,079] {540}
McLennan	10,263	10,316	10,383	10,450	10,580 (2,116) [508] {254}	10,714 (2,143) [514] {257}	10,851 (2,170) [521] {260}
Montgomery	14,192	14,210	14,227	14,231	14,293 (2,859) [686] {343}	14,349 (2,870) [689] {344}	14,399 (2,880) [691] {346}
Tarrant	67,484	68,233	68,803	69,519	70,965 (14,193) [3,406] {1,703}	72,453 (14,491) [3,478] {1,739}	73,984 (14,797) [3,551] {1,776}
Travis	32,143	32,220	32,303	32,451	32,649 (6,530) [1,567] {784}	32,852 (6,570) [1,577] {788}	33,061 (6,612) [1,587] {793}
Williamson	9,613	9,639	9,664	9,708	9,776 (1,955) [469] {235}	9,846 (1,969) [473] {236}	9,918 (1,984) [476] {238}

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.