IEM's AI Modeling: Short-term COVID-19 Projections
Date: 11/10/20

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

The projections shown in this document are based on data pulled in as of 11/10/20 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
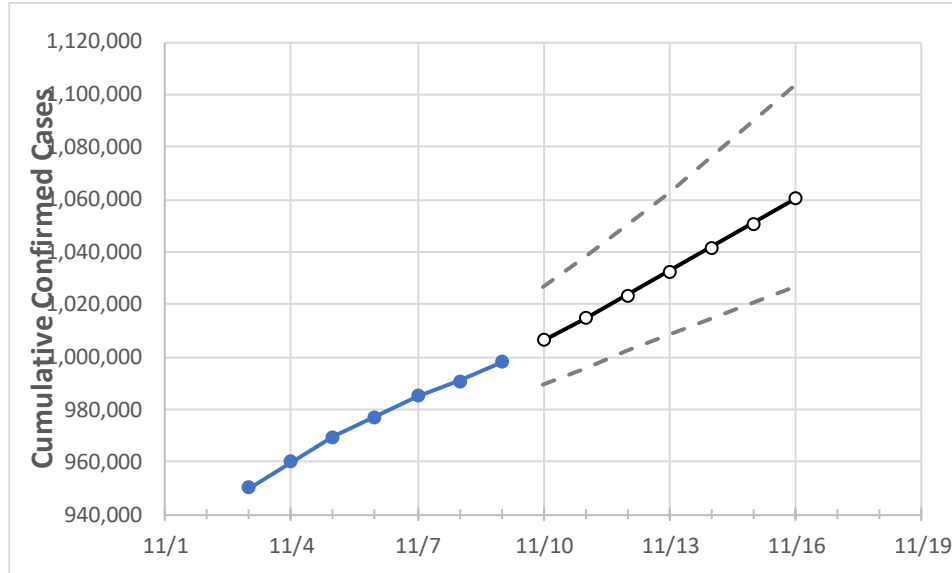
	Actual Confirmed Cases On:				Projected Cases For:						
	11/6	11/7	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15	11/16
Texas	977,222	985,061	990,930	998,027	1,006,302	1,014,783	1,023,475	1,032,382	1,041,507	1,050,857	1,060,437

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:						
	11/6	11/7	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15	11/16
Bexar	67,127	67,365	67,627	68,044	68,299	68,558	68,823	69,092	69,367	69,646	69,931
Brazoria	12,806	12,850	12,904	12,950	12,988	13,026	13,064	13,103	13,142	13,181	13,221
Brazos	7,974	8,052	8,106	8,146	8,195	8,245	8,297	8,349	8,404	8,459	8,516
Collin	19,701	19,810	20,165	20,313	20,528	20,754	20,989	21,236	21,494	21,764	22,046
Dallas	99,761	100,628	101,282	102,089	102,751	103,429	104,123	104,834	105,562	106,307	107,069
Denton	15,566	15,737	15,777	15,777	15,892	16,008	16,127	16,249	16,372	16,499	16,627
El Paso	59,852	61,104	63,161	64,158	66,099	68,104	70,174	72,311	74,516	76,791	79,136
Ellis	5,229	5,229	5,229	5,229	5,258	5,288	5,318	5,350	5,382	5,416	5,450
Fort Bend	18,090	18,135	18,135	18,135	18,172	18,209	18,248	18,287	18,326	18,367	18,408
Galveston	12,979	13,023	13,078	13,078	13,145	13,216	13,289	13,366	13,446	13,530	13,617
Harris	165,967	166,545	167,331	167,956	168,647	169,354	170,078	170,819	171,577	172,353	173,147
Hidalgo	36,686	36,752	36,818	36,884	36,986	37,090	37,194	37,299	37,404	37,511	37,618
Johnson	4,006	4,007	4,007	4,007	4,023	4,040	4,056	4,072	4,088	4,103	4,119
Lubbock	21,746	22,184	22,323	22,634	23,024	23,423	23,833	24,253	24,683	25,124	25,576
McLennan	10,784	10,917	11,093	11,093	11,216	11,345	11,480	11,622	11,771	11,926	12,090
Montgomery	14,280	14,280	14,280	14,280	14,339	14,399	14,459	14,520	14,581	14,643	14,705
Tarrant	72,118	73,180	73,636	75,161	76,115	77,102	78,123	79,179	80,271	81,400	82,568
Travis	32,928	33,016	33,168	33,382	33,538	33,700	33,869	34,044	34,227	34,416	34,613
Williamson	9,848	9,902	9,957	10,011	10,061	10,112	10,165	10,220	10,277	10,335	10,396

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:		
	11/6	11/7	11/8	11/9	11/11	11/13	11/15
Bexar	67,127	67,365	67,627	68,044	68,558 (13,712) [3,291] {1,645}	69,092 (13,818) [3,316] {1,658}	69,646 (13,929) [3,343] {1,672}
Brazoria	12,806	12,850	12,904	12,950	13,026 (2,605) [625] {313}	13,103 (2,621) [629] {314}	13,181 (2,636) [633] {316}
Brazos	7,974	8,052	8,106	8,146	8,245 (1,649) [396] {198}	8,349 (1,670) [401] {200}	8,459 (1,692) [406] {203}
Collin	19,701	19,810	20,165	20,313	20,754 (4,151) [996] {498}	21,236 (4,247) [1,019] {510}	21,764 (4,353) [1,045] {522}
Dallas	99,761	100,628	101,282	102,089	103,429 (20,686) [4,965] {2,482}	104,834 (20,967) [5,032] {2,516}	106,307 (21,261) [5,103] {2,551}
Denton	15,566	15,737	15,777	15,777	16,008 (3,202) [768] {384}	16,249 (3,250) [780] {390}	16,499 (3,300) [792] {396}
El Paso	59,852	61,104	63,161	64,158	68,104 (13,621) [3,269] {1,634}	72,311 (14,462) [3,471] {1,735}	76,791 (15,358) [3,686] {1,843}
Ellis	5,229	5,229	5,229	5,229	5,288 (1,058) [254] {127}	5,350 (1,070) [257] {128}	5,416 (1,083) [260] {130}
Fort Bend	18,090	18,135	18,135	18,135	18,209 (3,642) [874] {437}	18,287 (3,657) [878] {439}	18,367 (3,673) [882] {441}
Galveston	12,979	13,023	13,078	13,078	13,216 (2,643) [634] {317}	13,366 (2,673) [642] {321}	13,530 (2,706) [649] {325}
Harris	165,967	166,545	167,331	167,956	169,354 (33,871) [8,129] {4,064}	170,819 (34,164) [8,199] {4,100}	172,353 (34,471) [8,273] {4,136}
Hidalgo	36,686	36,752	36,818	36,884	37,090 (7,418) [1,780] {890}	37,299 (7,460) [1,790] {895}	37,511 (7,502) [1,801] {900}
Johnson	4,006	4,007	4,007	4,007	4,040 (808) [194] {97}	4,072 (814) [195] {98}	4,103 (821) [197] {98}
Lubbock	21,746	22,184	22,323	22,634	23,423 (4,685) [1,124] {562}	24,253 (4,851) [1,164] {582}	25,124 (5,025) [1,206] {603}
McLennan	10,784	10,917	11,093	11,093	11,345 (2,269) [545] {272}	11,622 (2,324) [558] {279}	11,926 (2,385) [572] {286}
Montgomery	14,280	14,280	14,280	14,280	14,399 (2,880) [691] {346}	14,520 (2,904) [697] {348}	14,643 (2,929) [703] {351}
Tarrant	72,118	73,180	73,636	75,161	77,102 (15,420) [3,701] {1,850}	79,179 (15,836) [3,801] {1,900}	81,400 (16,280) [3,907] {1,954}
Travis	32,928	33,016	33,168	33,382	33,700 (6,740) [1,618] {809}	34,044 (6,809) [1,634] {817}	34,416 (6,883) [1,652] {826}
Williamson	9,848	9,902	9,957	10,011	10,112 (2,022) [485] {243}	10,220 (2,044) [491] {245}	10,335 (2,067) [496] {248}

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.