IEM's AI Modeling: Short-term COVID-19 Projections
Date: 12/9/20

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 12/9/20 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
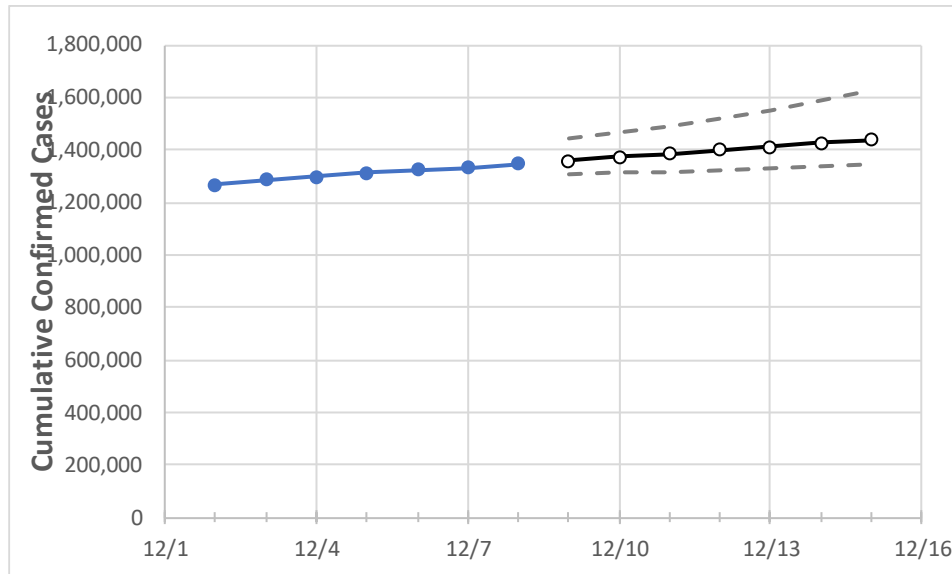
	Actual Confirmed Cases On:				Projected Cases For:						
	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14	12/15
Texas	1,311,643	1,322,738	1,331,719	1,346,643	1,359,253	1,372,097	1,385,177	1,398,494	1,412,052	1,425,852	1,439,899

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:						
	12/5	12/6	12/7	12/8	12/9	12/10	12/11	12/12	12/13	12/14	12/15
Bexar	85,895	86,986	88,196	89,490	90,641	91,842	93,093	94,397	95,756	97,172	98,648
Brazoria	15,622	15,734	15,841	15,977	16,173	16,382	16,604	16,841	17,093	17,360	17,645
Brazos	11,616	11,672	11,748	11,830	11,896	11,962	12,028	12,095	12,162	12,229	12,297
Collin	28,547	29,239	29,554	29,797	30,245	30,706	31,181	31,669	32,172	32,688	33,220
Dallas	146,320	148,172	149,556	150,940	152,171	153,426	154,705	156,009	157,338	158,692	160,072
Denton	26,034	26,329	26,623	27,181	27,606	28,048	28,509	28,989	29,489	30,009	30,551
El Paso	89,540	89,762	90,222	90,748	91,091	91,417	91,727	92,021	92,300	92,565	92,817
Ellis	7,905	8,027	8,148	8,270	8,386	8,507	8,635	8,769	8,910	9,058	9,214
Fort Bend	23,389	24,372	24,528	24,683	25,060	25,473	25,923	26,416	26,953	27,540	28,182
Galveston	15,348	15,537	15,657	15,776	15,838	15,900	15,963	16,028	16,093	16,160	16,227
Harris	196,658	198,961	199,597	200,397	201,033	201,668	202,303	202,936	203,569	204,201	204,832
Hidalgo	45,484	45,580	45,677	45,773	45,917	46,060	46,200	46,339	46,476	46,611	46,744
Johnson	6,364	6,486	6,607	6,729	6,853	6,984	7,121	7,266	7,418	7,578	7,747
Lubbock	34,074	34,445	34,722	34,886	35,121	35,347	35,563	35,771	35,971	36,162	36,346
McLennan	14,937	15,092	15,212	15,331	15,439	15,546	15,652	15,758	15,864	15,969	16,073
Montgomery	19,151	19,367	19,584	19,784	20,029	20,279	20,535	20,795	21,061	21,331	21,608
Tarrant	108,480	110,015	111,865	112,725	113,831	114,960	116,112	117,288	118,488	119,712	120,960
Travis	39,925	40,209	40,481	40,836	41,141	41,453	41,773	42,100	42,436	42,779	43,130
Williamson	14,186	14,359	14,533	14,827	15,036	15,251	15,470	15,695	15,925	16,161	16,402

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:		
	12/5	12/6	12/7	12/8	12/10	12/12	12/14
Bexar	85,895	86,986	88,196	89,490	91,842 (18,368) [4,408] {2,204}	94,397 (18,879) [4,531] {2,266}	97,172 (19,434) [4,664] {2,332}
Brazoria	15,622	15,734	15,841	15,977	16,382 (3,276) [786] {393}	16,841 (3,368) [808] {404}	17,360 (3,472) [833] {417}
Brazos	11,616	11,672	11,748	11,830	11,962 (2,392) [574] {287}	12,095 (2,419) [581] {290}	12,229 (2,446) [587] {294}
Collin	28,547	29,239	29,554	29,797	30,706 (6,141) [1,474] {737}	31,669 (6,334) [1,520] {760}	32,688 (6,538) [1,569] {785}
Dallas	146,320	148,172	149,556	150,940	153,426 (30,685) [7,364] {3,682}	156,009 (31,202) [7,488] {3,744}	158,692 (31,738) [7,617] {3,809}
Denton	26,034	26,329	26,623	27,181	28,048 (5,610) [1,346] {673}	28,989 (5,798) [1,391] {696}	30,009 (6,002) [1,440] {720}
El Paso	89,540	89,762	90,222	90,748	91,417 (18,283) [4,388] {2,194}	92,021 (18,404) [4,417] {2,208}	92,565 (18,513) [4,443] {2,222}
Ellis	7,905	8,027	8,148	8,270	8,507 (1,701) [408] {204}	8,769 (1,754) [421] {210}	9,058 (1,812) [435] {217}
Fort Bend	23,389	24,372	24,528	24,683	25,473 (5,095) [1,223] {611}	26,416 (5,283) [1,268] {634}	27,540 (5,508) [1,322] {661}
Galveston	15,348	15,537	15,657	15,776	15,900 (3,180) [763] {382}	16,028 (3,206) [769] {385}	16,160 (3,232) [776] {388}
Harris	196,658	198,961	199,597	200,397	201,668 (40,334) [9,680] {4,840}	202,936 (40,587) [9,741] {4,870}	204,201 (40,840) [9,802] {4,901}
Hidalgo	45,484	45,580	45,677	45,773	46,060 (9,212) [2,211] {1,105}	46,339 (9,268) [2,224] {1,112}	46,611 (9,322) [2,237] {1,119}
Johnson	6,364	6,486	6,607	6,729	6,984 (1,397) [335] {168}	7,266 (1,453) [349] {174}	7,578 (1,516) [364] {182}
Lubbock	34,074	34,445	34,722	34,886	35,347 (7,069) [1,697] {848}	35,771 (7,154) [1,717] {859}	36,162 (7,232) [1,736] {868}
McLennan	14,937	15,092	15,212	15,331	15,546 (3,109) [746] {373}	15,758 (3,152) [756] {378}	15,969 (3,194) [766] {383}
Montgomery	19,151	19,367	19,584	19,784	20,279 (4,056) [973] {487}	20,795 (4,159) [998] {499}	21,331 (4,266) [1,024] {512}
Tarrant	108,480	110,015	111,865	112,725	114,960 (22,992) [5,518] {2,759}	117,288 (23,458) [5,630] {2,815}	119,712 (23,942) [5,746] {2,873}
Travis	39,925	40,209	40,481	40,836	41,453 (8,291) [1,990] {995}	42,100 (8,420) [2,021] {1,010}	42,779 (8,556) [2,053] {1,027}
Williamson	14,186	14,359	14,533	14,827	15,251 (3,050) [732] {366}	15,695 (3,139) [753] {377}	16,161 (3,232) [776] {388}

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.