IEM's AI Modeling: Short-term COVID-19 Projections
Date: 12/17/20

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 12/17/20 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
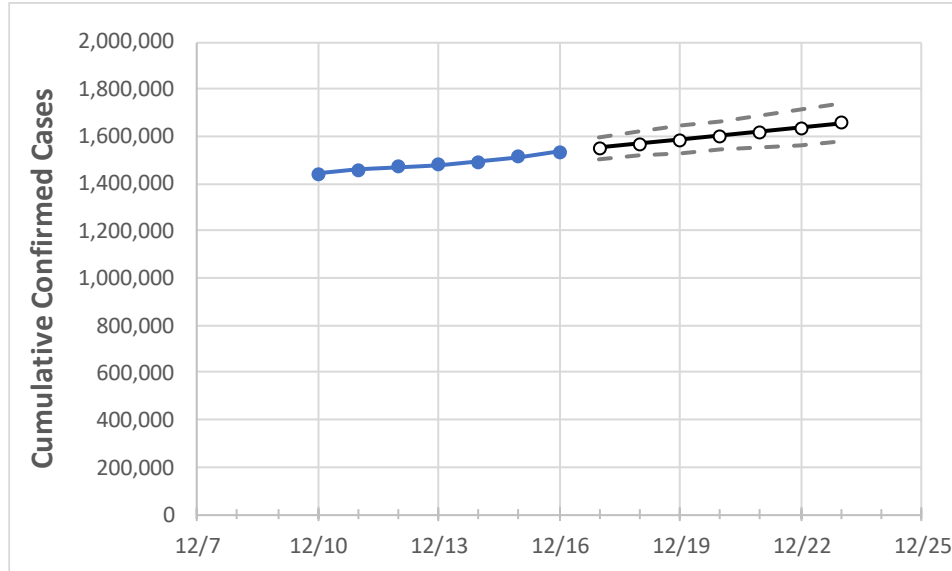
	Actual Confirmed Cases On:				Projected Cases For:						
	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23
Texas	1,481,899	1,491,942	1,512,531	1,534,450	1,550,970	1,567,783	1,584,890	1,602,292	1,619,991	1,637,988	1,656,287

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:						
	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23
Bexar	94,182	94,781	96,140	97,536	98,772	100,031	101,314	102,621	103,952	105,307	106,687
Brazoria	16,907	17,386	17,511	17,845	18,128	18,425	18,739	19,069	19,416	19,781	20,165
Brazos	12,464	12,571	12,664	12,771	12,886	13,004	13,123	13,244	13,366	13,491	13,618
Collin	35,186	35,794	36,640	37,433	38,220	39,037	39,885	40,763	41,674	42,618	43,596
Dallas	160,146	161,845	163,792	166,230	168,366	170,564	172,823	175,146	177,531	179,981	182,497
Denton	30,306	30,725	31,587	32,285	33,007	33,761	34,547	35,367	36,222	37,114	38,044
El Paso	92,810	93,223	93,455	93,859	94,138	94,405	94,660	94,905	95,138	95,362	95,575
Ellis	9,880	10,035	10,189	10,403	10,566	10,732	10,901	11,073	11,248	11,425	11,605
Fort Bend	29,844	29,943	30,042	30,201	30,707	31,244	31,815	32,421	33,064	33,748	34,473
Galveston	17,362	17,496	17,629	17,753	17,933	18,119	18,311	18,508	18,712	18,921	19,138
Harris	207,406	208,737	210,362	212,686	214,329	216,015	217,745	219,519	221,337	223,202	225,113
Hidalgo	47,411	47,562	48,009	48,386	48,663	48,939	49,216	49,492	49,767	50,043	50,317
Johnson	8,202	8,332	8,462	8,658	8,828	9,002	9,181	9,363	9,549	9,740	9,934
Lubbock	36,261	36,611	36,933	37,528	37,803	38,074	38,340	38,603	38,862	39,116	39,367
McLennan	16,274	16,353	16,431	16,570	16,707	16,844	16,980	17,115	17,250	17,384	17,517
Montgomery	21,012	21,208	21,608	22,007	22,292	22,583	22,879	23,181	23,489	23,803	24,123
Tarrant	119,630	120,899	122,443	124,420	125,990	127,577	129,180	130,798	132,432	134,081	135,745
Travis	42,441	42,856	43,469	43,836	44,259	44,695	45,144	45,607	46,085	46,576	47,082
Williamson	17,315	17,501	17,687	18,091	18,360	18,636	18,918	19,208	19,505	19,810	20,122

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:		
	12/13	12/14	12/15	12/16	12/18	12/20	12/22
Bexar	94,182	94,781	96,140	97,536	100,031 (20,006) [4,802] {2,401}	102,621 (20,524) [4,926] {2,463}	105,307 (21,061) [5,055] {2,527}
Brazoria	16,907	17,386	17,511	17,845	18,425 (3,685) [884] {442}	19,069 (3,814) [915] {458}	19,781 (3,956) [949] {475}
Brazos	12,464	12,571	12,664	12,771	13,004 (2,601) [624] {312}	13,244 (2,649) [636] {318}	13,491 (2,698) [648] {324}
Collin	35,186	35,794	36,640	37,433	39,037 (7,807) [1,874] {937}	40,763 (8,153) [1,957] {978}	42,618 (8,524) [2,046] {1,023}
Dallas	160,146	161,845	163,792	166,230	170,564 (34,113) [8,187] {4,094}	175,146 (35,029) [8,407] {4,203}	179,981 (35,996) [8,639] {4,320}
Denton	30,306	30,725	31,587	32,285	33,761 (6,752) [1,621] {810}	35,367 (7,073) [1,698] {849}	37,114 (7,423) [1,781] {891}
El Paso	92,810	93,223	93,455	93,859	94,405 (18,881) [4,531] {2,266}	94,905 (18,981) [4,555] {2,278}	95,362 (19,072) [4,577] {2,289}
Ellis	9,880	10,035	10,189	10,403	10,732 (2,146) [515] {258}	11,073 (2,215) [532] {266}	11,425 (2,285) [548] {274}
Fort Bend	29,844	29,943	30,042	30,201	31,244 (6,249) [1,500] {750}	32,421 (6,484) [1,556] {778}	33,748 (6,750) [1,620] {810}
Galveston	17,362	17,496	17,629	17,753	18,119 (3,624) [870] {435}	18,508 (3,702) [888] {444}	18,921 (3,784) [908] {454}
Harris	207,406	208,737	210,362	212,686	216,015 (43,203) [10,369] {5,184}	219,519 (43,904) [10,537] {5,268}	223,202 (44,640) [10,714] {5,357}
Hidalgo	47,411	47,562	48,009	48,386	48,939 (9,788) [2,349] {1,175}	49,492 (9,898) [2,376] {1,188}	50,043 (10,009) [2,402] {1,201}
Johnson	8,202	8,332	8,462	8,658	9,002 (1,800) [432] {216}	9,363 (1,873) [449] {225}	9,740 (1,948) [468] {234}
Lubbock	36,261	36,611	36,933	37,528	38,074 (7,615) [1,828] {914}	38,603 (7,721) [1,853] {926}	39,116 (7,823) [1,878] {939}
McLennan	16,274	16,353	16,431	16,570	16,844 (3,369) [809] {404}	17,115 (3,423) [822] {411}	17,384 (3,477) [834] {417}
Montgomery	21,012	21,208	21,608	22,007	22,583 (4,517) [1,084] {542}	23,181 (4,636) [1,113] {556}	23,803 (4,761) [1,143] {571}
Tarrant	119,630	120,899	122,443	124,420	127,577 (25,515) [6,124] {3,062}	130,798 (26,160) [6,278] {3,139}	134,081 (26,816) [6,436] {3,218}
Travis	42,441	42,856	43,469	43,836	44,695 (8,939) [2,145] {1,073}	45,607 (9,121) [2,189] {1,095}	46,576 (9,315) [2,236] {1,118}
Williamson	17,315	17,501	17,687	18,091	18,636 (3,727) [895] {447}	19,208 (3,842) [922] {461}	19,810 (3,962) [951] {475}

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.