IEM's AI Modeling: Short-term COVID-19 Projections
Date: 5/21/21

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 5/21
/21 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
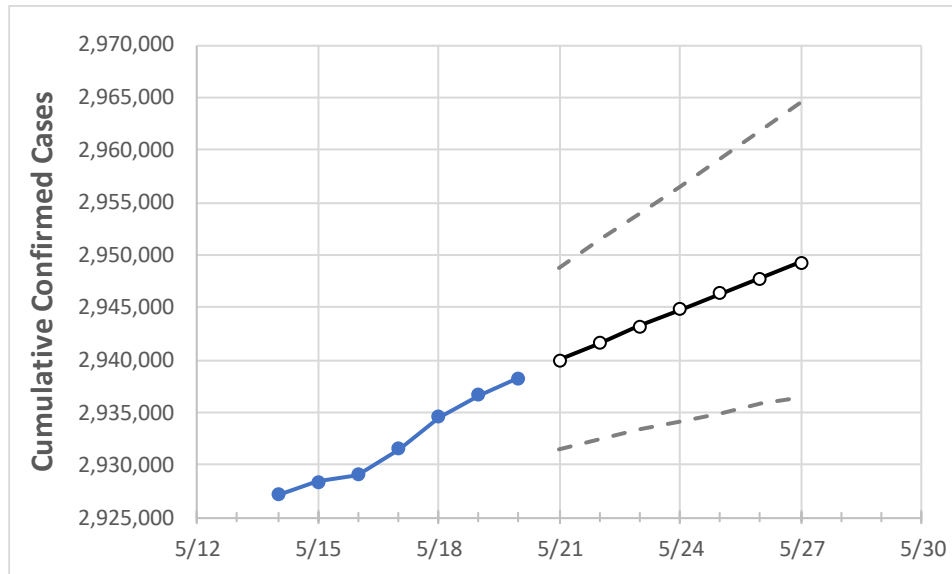
	Actual Confirmed Cases On:				Projected Cases For:						
	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25	5/26	5/27
Texas	2,931,500	2,934,592	2,936,614	2,938,261	2,939,937	2,941,559	2,943,187	2,944,778	2,946,311	2,947,801	2,949,286

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

Texas Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	5/17	5/18	5/19	5/20	5/21	5/22	5/23	5/24	5/25	5/26	5/27
Bexar	221,178	221,337	221,485	221,603	221,744	221,883	222,019	222,154	222,281	222,406	222,524
Brazoria	37,831	37,834	37,921	37,972	38,001	38,030	38,058	38,086	38,114	38,140	38,165
Brazos	26,767	26,793	26,801	26,813	26,830	26,845	26,860	26,875	26,890	26,904	26,918
Collin	91,038	91,124	91,157	91,182	91,230	91,275	91,318	91,362	91,403	91,442	91,480
Dallas	301,918	301,990	302,150	302,240	302,360	302,473	302,583	302,695	302,805	302,909	303,011
Denton	75,469	75,568	75,621	75,656	75,712	75,764	75,818	75,871	75,924	75,974	76,026
El Paso	135,448	135,570	135,699	135,758	135,831	135,904	135,977	136,047	136,116	136,186	136,256
Ellis	22,896	22,914	22,933	22,942	22,956	22,969	22,982	22,996	23,010	23,024	23,038
Fort Bend	68,105	68,199	68,300	68,369	68,423	68,476	68,529	68,580	68,632	68,680	68,725
Galveston	39,869	39,905	39,973	40,025	40,073	40,123	40,172	40,220	40,268	40,316	40,364
Harris	396,799	397,046	397,337	397,578	397,762	397,934	398,099	398,263	398,423	398,574	398,724
Hidalgo	90,193	90,391	90,589	90,675	90,783	90,888	90,995	91,100	91,207	91,316	91,419
Johnson	19,793	19,867	19,875	19,885	19,913	19,942	19,970	20,002	20,034	20,069	20,105
Lubbock	49,174	49,188	49,207	49,223	49,239	49,255	49,272	49,289	49,305	49,321	49,338
McLennan	27,280	27,292	27,320	27,333	27,347	27,361	27,373	27,386	27,399	27,411	27,423
Montgomery	53,802	53,875	53,936	53,976	54,041	54,103	54,166	54,228	54,288	54,348	54,407
Tarrant	259,447	259,584	259,697	259,847	259,975	260,102	260,221	260,342	260,465	260,585	260,703
Travis	83,366	83,403	83,457	83,495	83,540	83,583	83,624	83,664	83,703	83,741	83,777
Williamson	46,396	46,442	46,477	46,497	46,535	46,571	46,607	46,642	46,675	46,707	46,737

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:		
	5/17	5/18	5/19	5/20	5/22	5/24	5/26
Bexar	221,178	221,337	221,485	221,603	221,883 (44,377) [10,650] {5,325}	222,154 (44,431) [10,663] {5,332}	222,406 (44,481) [10,675] {5,338}
Brazoria	37,831	37,834	37,921	37,972	38,030 (7,606) [1,825] {913}	38,086 (7,617) [1,828] {914}	38,140 (7,628) [1,831] {915}
Brazos	26,767	26,793	26,801	26,813	26,845 (5,369) [1,289] {644}	26,875 (5,375) [1,290] {645}	26,904 (5,381) [1,291] {646}
Collin	91,038	91,124	91,157	91,182	91,275 (18,255) [4,381] {2,191}	91,362 (18,272) [4,385] {2,193}	91,442 (18,288) [4,389] {2,195}
Dallas	301,918	301,990	302,150	302,240	302,473 (60,495) [14,519] {7,259}	302,695 (60,539) [14,529] {7,265}	302,909 (60,582) [14,540] {7,270}
Denton	75,469	75,568	75,621	75,656	75,764 (15,153) [3,637] {1,818}	75,871 (15,174) [3,642] {1,821}	75,974 (15,195) [3,647] {1,823}
El Paso	135,448	135,570	135,699	135,758	135,904 (27,181) [6,523] {3,262}	136,047 (27,209) [6,530] {3,265}	136,186 (27,237) [6,537] {3,268}
Ellis	22,896	22,914	22,933	22,942	22,969 (4,594) [1,103] {551}	22,996 (4,599) [1,104] {552}	23,024 (4,605) [1,105] {553}
Fort Bend	68,105	68,199	68,300	68,369	68,476 (13,695) [3,287] {1,643}	68,580 (13,716) [3,292] {1,646}	68,680 (13,736) [3,297] {1,648}
Galveston	39,869	39,905	39,973	40,025	40,123 (8,025) [1,926] {963}	40,220 (8,044) [1,931] {965}	40,316 (8,063) [1,935] {968}
Harris	396,799	397,046	397,337	397,578	397,934 (79,587) [19,101] {9,550}	398,263 (79,653) [19,117] {9,558}	398,574 (79,715) [19,132] {9,566}
Hidalgo	90,193	90,391	90,589	90,675	90,888 (18,178) [4,363] {2,181}	91,100 (18,220) [4,373] {2,186}	91,316 (18,263) [4,383] {2,192}
Johnson	19,793	19,867	19,875	19,885	19,942 (3,988) [957] {479}	20,002 (4,000) [960] {480}	20,069 (4,014) [963] {482}
Lubbock	49,174	49,188	49,207	49,223	49,255 (9,851) [2,364] {1,182}	49,289 (9,858) [2,366] {1,183}	49,321 (9,864) [2,367] {1,184}
McLennan	27,280	27,292	27,320	27,333	27,361 (5,472) [1,313] {657}	27,386 (5,477) [1,315] {657}	27,411 (5,482) [1,316] {658}
Montgomery	53,802	53,875	53,936	53,976	54,103 (10,821) [2,597] {1,298}	54,228 (10,846) [2,603] {1,301}	54,348 (10,870) [2,609] {1,304}
Tarrant	259,447	259,584	259,697	259,847	260,102 (52,020) [12,485] {6,242}	260,342 (52,068) [12,496] {6,248}	260,585 (52,117) [12,508] {6,254}
Travis	83,366	83,403	83,457	83,495	83,583 (16,717) [4,012] {2,006}	83,664 (16,733) [4,016] {2,008}	83,741 (16,748) [4,020] {2,010}
Williamson	46,396	46,442	46,477	46,497	46,571 (9,314) [2,235] {1,118}	46,642 (9,328) [2,239] {1,119}	46,707 (9,341) [2,242] {1,121}

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.