IEM's AI Modeling: Short-term COVID-19 Projections
Date: 3/1/21

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 3/1/21 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
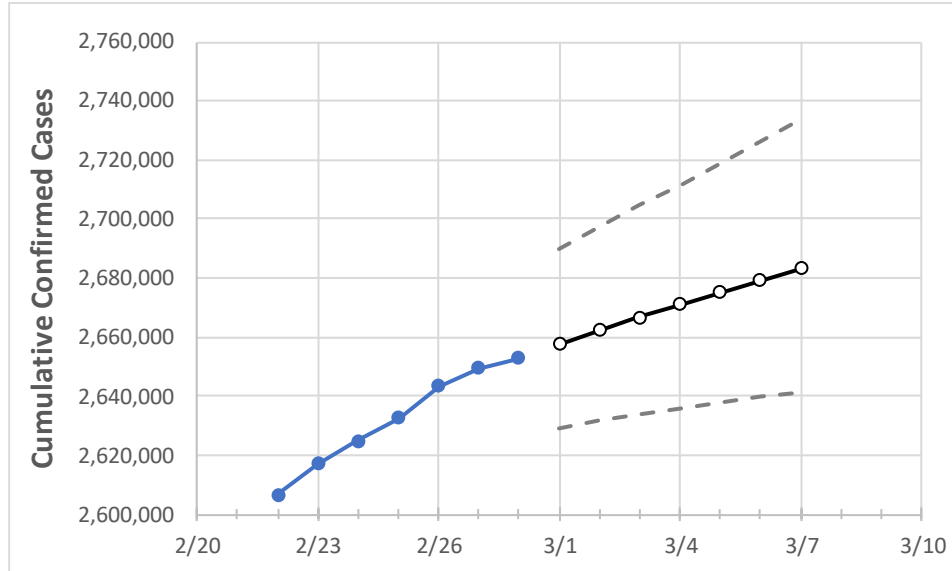
	Actual Confirmed Cases On:				Projected Cases For:						
	2/25	2/26	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7
Texas	2,632,666	2,643,463	2,649,363	2,653,013	2,657,775	2,662,294	2,666,737	2,671,158	2,675,329	2,679,184	2,683,398

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:						
	2/25	2/26	2/27	2/28	3/1	3/2	3/3	3/4	3/5	3/6	3/7
Bexar	194,736	195,237	195,719	196,528	197,185	197,850	198,526	199,193	199,863	200,536	201,200
Brazoria	32,289	32,573	32,645	32,834	32,964	33,091	33,227	33,356	33,495	33,622	33,750
Brazos	20,786	20,923	20,923	20,923	20,979	21,035	21,090	21,144	21,199	21,254	21,306
Collin	82,390	82,848	83,100	83,289	83,463	83,625	83,782	83,940	84,085	84,227	84,365
Dallas	279,108	279,834	280,404	280,404	280,661	280,899	281,121	281,345	281,556	281,751	281,930
Denton	63,122	63,648	63,994	63,994	64,276	64,558	64,836	65,110	65,400	65,676	65,954
El Paso	122,774	122,966	123,445	123,690	123,922	124,158	124,389	124,620	124,840	125,062	125,276
Ellis	20,589	20,659	20,714	20,714	20,741	20,765	20,788	20,811	20,831	20,851	20,870
Fort Bend	57,225	57,572	57,572	57,572	57,744	57,903	58,074	58,241	58,412	58,584	58,745
Galveston	34,137	34,269	34,431	34,591	34,684	34,779	34,875	34,968	35,059	35,150	35,241
Harris	344,898	348,125	348,848	350,201	351,061	351,913	352,731	353,590	354,479	355,316	356,168
Hidalgo	75,701	76,684	76,684	76,684	77,148	77,614	78,082	78,538	79,000	79,486	79,967
Johnson	18,409	18,477	18,518	18,518	18,547	18,574	18,600	18,624	18,647	18,669	18,690
Lubbock	48,068	48,098	48,123	48,147	48,164	48,181	48,196	48,211	48,225	48,238	48,250
McLennan	24,896	24,966	25,024	25,024	25,098	25,172	25,251	25,329	25,410	25,493	25,576
Montgomery	44,862	44,999	44,999	44,999	45,093	45,186	45,281	45,364	45,446	45,530	45,606
Tarrant	240,416	241,005	241,650	241,650	241,960	242,272	242,575	242,859	243,132	243,378	243,621
Travis	75,047	75,362	75,617	75,636	75,751	75,862	75,978	76,081	76,188	76,293	76,392
Williamson	39,586	39,586	39,586	39,586	56,496	76,446	98,455	122,709	149,483	178,164	207,245

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:		
	2/25	2/26	2/27	2/28	3/2	3/4	3/6
Bexar	194,736	195,237	195,719	196,528	197,850 (39,570) [9,497] {4,748}	199,193 (39,839) [9,561] {4,781}	200,536 (40,107) [9,626] {4,813}
Brazoria	32,289	32,573	32,645	32,834	33,091 (6,618) [1,588] {794}	33,356 (6,671) [1,601] {801}	33,622 (6,724) [1,614] {807}
Brazos	20,786	20,923	20,923	20,923	21,035 (4,207) [1,010] {505}	21,144 (4,229) [1,015] {507}	21,254 (4,251) [1,020] {510}
Collin	82,390	82,848	83,100	83,289	83,625 (16,725) [4,014] {2,007}	83,940 (16,788) [4,029] {2,015}	84,227 (16,845) [4,043] {2,021}
Dallas	279,108	279,834	280,404	280,404	280,899 (56,180) [13,483] {6,742}	281,345 (56,269) [13,505] {6,752}	281,751 (56,350) [13,524] {6,762}
Denton	63,122	63,648	63,994	63,994	64,558 (12,912) [3,099] {1,549}	65,110 (13,022) [3,125] {1,563}	65,676 (13,135) [3,152] {1,576}
El Paso	122,774	122,966	123,445	123,690	124,158 (24,832) [5,960] {2,980}	124,620 (24,924) [5,982] {2,991}	125,062 (25,012) [6,003] {3,001}
Ellis	20,589	20,659	20,714	20,714	20,765 (4,153) [997] {498}	20,811 (4,162) [999] {499}	20,851 (4,170) [1,001] {500}
Fort Bend	57,225	57,572	57,572	57,572	57,903 (11,581) [2,779] {1,390}	58,241 (11,648) [2,796] {1,398}	58,584 (11,717) [2,812] {1,406}
Galveston	34,137	34,269	34,431	34,591	34,779 (6,956) [1,669] {835}	34,968 (6,994) [1,678] {839}	35,150 (7,030) [1,687] {844}
Harris	344,898	348,125	348,848	350,201	351,913 (70,383) [16,892] {8,446}	353,590 (70,718) [16,972] {8,486}	355,316 (71,063) [17,055] {8,528}
Hidalgo	75,701	76,684	76,684	76,684	77,614 (15,523) [3,725] {1,863}	78,538 (15,708) [3,770] {1,885}	79,486 (15,897) [3,815] {1,908}
Johnson	18,409	18,477	18,518	18,518	18,574 (3,715) [892] {446}	18,624 (3,725) [894] {447}	18,669 (3,734) [896] {448}
Lubbock	48,068	48,098	48,123	48,147	48,181 (9,636) [2,313] {1,156}	48,211 (9,642) [2,314] {1,157}	48,238 (9,648) [2,315] {1,158}
McLennan	24,896	24,966	25,024	25,024	25,172 (5,034) [1,208] {604}	25,329 (5,066) [1,216] {608}	25,493 (5,099) [1,224] {612}
Montgomery	44,862	44,999	44,999	44,999	45,186 (9,037) [2,169] {1,084}	45,364 (9,073) [2,177] {1,089}	45,530 (9,106) [2,185] {1,093}
Tarrant	240,416	241,005	241,650	241,650	242,272 (48,454) [11,629] {5,815}	242,859 (48,572) [11,657] {5,829}	243,378 (48,676) [11,682] {5,841}
Travis	75,047	75,362	75,617	75,636	75,862 (15,172) [3,641] {1,821}	76,081 (15,216) [3,652] {1,826}	76,293 (15,259) [3,662] {1,831}
Williamson	39,586	39,586	39,586	39,586	76,446 (15,289) [3,669] {1,835}	122,709 (24,542) [5,890] {2,945}	178,164 (35,633) [8,552] {4,276}

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.