IEM's AI Modeling: Short-term COVID-19 Projections
Date: 7/16/21

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 7/16/21 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
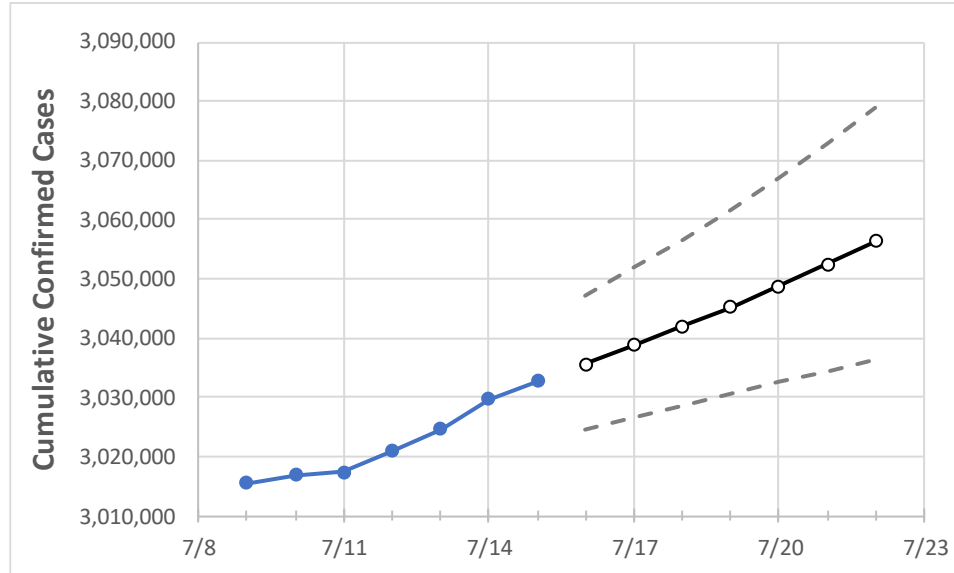
	Actual Confirmed Cases On:				Projected Cases For:						
	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20	7/21	7/22
Texas	3,020,886	3,024,610	3,029,676	3,032,699	3,035,669	3,038,725	3,041,973	3,045,291	3,048,838	3,052,536	3,056,415

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:						
	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20	7/21	7/22
Bexar	230,056	230,339	230,623	230,623	230,933	231,255	231,590	231,940	232,303	232,676	233,072
Brazoria	39,106	39,132	39,165	39,337	39,390	39,448	39,507	39,574	39,641	39,713	39,792
Brazos	28,145	28,173	28,210	28,235	28,253	28,272	28,290	28,309	28,330	28,352	28,373
Collin	93,698	93,727	93,799	93,904	93,984	94,068	94,153	94,241	94,333	94,428	94,528
Dallas	308,087	308,520	308,953	309,238	309,501	309,774	310,058	310,358	310,673	310,990	311,328
Denton	77,556	77,665	77,768	77,820	77,891	77,965	78,044	78,125	78,209	78,299	78,393
El Paso	136,901	136,964	136,999	137,063	137,103	137,144	137,188	137,234	137,282	137,331	137,385
Ellis	23,155	23,167	23,159	23,218	23,236	23,255	23,275	23,295	23,316	23,337	23,360
Fort Bend	70,292	70,470	70,594	70,638	70,686	70,738	70,793	70,848	70,901	70,959	71,015
Galveston	41,679	41,727	41,779	41,838	41,904	41,972	42,042	42,114	42,191	42,269	42,352
Harris	405,866	406,271	406,425	406,703	406,988	407,275	407,583	407,894	408,216	408,564	408,906
Hidalgo	94,214	94,369	94,617	94,737	94,861	94,992	95,126	95,268	95,414	95,568	95,727
Johnson	20,262	20,277	20,279	20,310	20,324	20,339	20,353	20,368	20,385	20,402	20,418
Lubbock	49,681	49,701	49,716	49,751	49,776	49,803	49,832	49,863	49,895	49,930	49,969
McLennan	27,984	27,984	27,984	27,984	27,995	28,006	28,017	28,029	28,041	28,054	28,067
Montgomery	56,078	56,137	56,311	56,311	56,391	56,475	56,564	56,655	56,750	56,853	56,958
Tarrant	264,500	264,652	264,827	265,214	265,362	265,516	265,673	265,836	265,996	266,166	266,344
Travis	85,284	85,486	85,614	85,787	85,887	85,993	86,109	86,230	86,359	86,498	86,639
Williamson	47,735	47,927	47,981	48,113	48,207	48,306	48,410	48,523	48,640	48,767	48,904

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:		
	7/12	7/13	7/14	7/15	7/17	7/19	7/21
Bexar	230,056	230,339	230,623	230,623	231,255 (46,251) [11,100] {5,550}	231,940 (46,388) [11,133] {5,567}	232,676 (46,535) [11,168] {5,584}
Brazoria	39,106	39,132	39,165	39,337	39,448 (7,890) [1,894] {947}	39,574 (7,915) [1,900] {950}	39,713 (7,943) [1,906] {953}
Brazos	28,145	28,173	28,210	28,235	28,272 (5,654) [1,357] {679}	28,309 (5,662) [1,359] {679}	28,352 (5,670) [1,361] {680}
Collin	93,698	93,727	93,799	93,904	94,068 (18,814) [4,515] {2,258}	94,241 (18,848) [4,524] {2,262}	94,428 (18,886) [4,533] {2,266}
Dallas	308,087	308,520	308,953	309,238	309,774 (61,955) [14,869] {7,435}	310,358 (62,072) [14,897] {7,449}	310,990 (62,198) [14,928] {7,464}
Denton	77,556	77,665	77,768	77,820	77,965 (15,593) [3,742] {1,871}	78,125 (15,625) [3,750] {1,875}	78,299 (15,660) [3,758] {1,879}
El Paso	136,901	136,964	136,999	137,063	137,144 (27,429) [6,583] {3,291}	137,234 (27,447) [6,587] {3,294}	137,331 (27,466) [6,592] {3,296}
Ellis	23,155	23,167	23,159	23,218	23,255 (4,651) [1,116] {558}	23,295 (4,659) [1,118] {559}	23,337 (4,667) [1,120] {560}
Fort Bend	70,292	70,470	70,594	70,638	70,738 (14,148) [3,395] {1,698}	70,848 (14,170) [3,401] {1,700}	70,959 (14,192) [3,406] {1,703}
Galveston	41,679	41,727	41,779	41,838	41,972 (8,394) [2,015] {1,007}	42,114 (8,423) [2,021] {1,011}	42,269 (8,454) [2,029] {1,014}
Harris	405,866	406,271	406,425	406,703	407,275 (81,455) [19,549] {9,775}	407,894 (81,579) [19,579] {9,789}	408,564 (81,713) [19,611] {9,806}
Hidalgo	94,214	94,369	94,617	94,737	94,992 (18,998) [4,560] {2,280}	95,268 (19,054) [4,573] {2,286}	95,568 (19,114) [4,587] {2,294}
Johnson	20,262	20,277	20,279	20,310	20,339 (4,068) [976] {488}	20,368 (4,074) [978] {489}	20,402 (4,080) [979] {490}
Lubbock	49,681	49,701	49,716	49,751	49,803 (9,961) [2,391] {1,195}	49,863 (9,973) [2,393] {1,197}	49,930 (9,986) [2,397] {1,198}
McLennan	27,984	27,984	27,984	27,984	28,006 (5,601) [1,344] {672}	28,029 (5,606) [1,345] {673}	28,054 (5,611) [1,347] {673}
Montgomery	56,078	56,137	56,311	56,311	56,475 (11,295) [2,711] {1,355}	56,655 (11,331) [2,719] {1,360}	56,853 (11,371) [2,729] {1,364}
Tarrant	264,500	264,652	264,827	265,214	265,516 (53,103) [12,745] {6,372}	265,836 (53,167) [12,760] {6,380}	266,166 (53,233) [12,776] {6,388}
Travis	85,284	85,486	85,614	85,787	85,993 (17,199) [4,128] {2,064}	86,230 (17,246) [4,139] {2,070}	86,498 (17,300) [4,152] {2,076}
Williamson	47,735	47,927	47,981	48,113	48,306 (9,661) [2,319] {1,159}	48,523 (9,705) [2,329] {1,165}	48,767 (9,753) [2,341] {1,170}

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.