IEM's AI Modeling: Short-term COVID-19 Projections
Date: 7/14/21

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 7/14/21 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
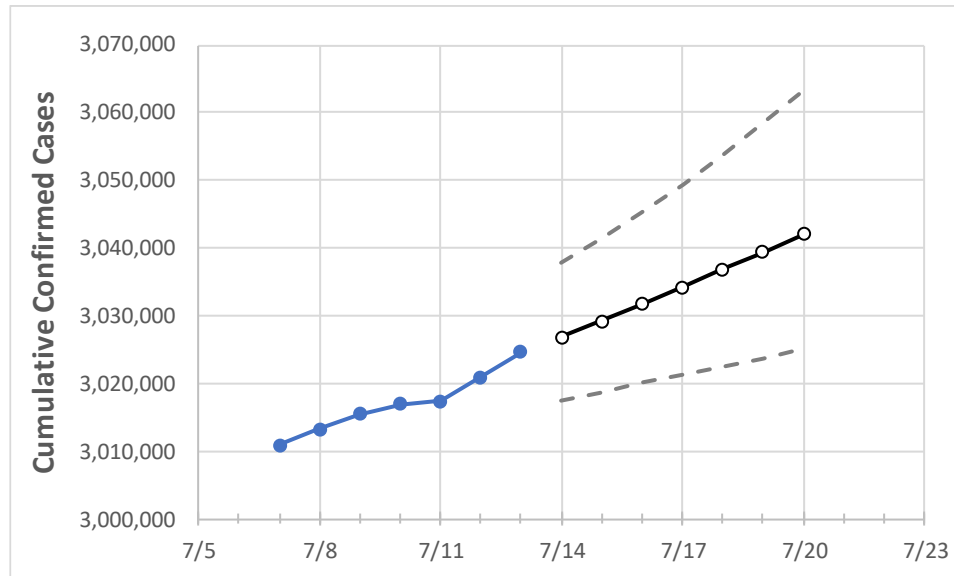
	Actual Confirmed Cases On:				Projected Cases For:						
	7/10	7/11	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20
Texas	3,016,891	3,017,321	3,020,886	3,024,610	3,026,898	3,029,216	3,031,646	3,034,179	3,036,810	3,039,418	3,042,107

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:						
	7/10	7/11	7/12	7/13	7/14	7/15	7/16	7/17	7/18	7/19	7/20
Bexar	228,638	228,638	228,638	228,638	228,710	228,779	228,843	228,906	228,969	229,028	229,085
Brazoria	39,053	39,079	39,106	39,132	39,170	39,210	39,252	39,294	39,340	39,385	39,432
Brazos	28,131	28,138	28,145	28,173	28,185	28,198	28,211	28,223	28,235	28,248	28,261
Collin	93,517	93,545	93,698	93,727	93,793	93,861	93,934	94,006	94,081	94,160	94,240
Dallas	307,963	308,025	308,087	308,087	308,236	308,383	308,538	308,694	308,847	309,012	309,176
Denton	77,462	77,509	77,556	77,665	77,723	77,782	77,840	77,904	77,969	78,035	78,103
El Paso	136,869	136,889	136,901	136,964	136,996	137,028	137,063	137,098	137,133	137,172	137,210
Ellis	23,131	23,143	23,155	23,167	23,177	23,186	23,196	23,206	23,215	23,224	23,234
Fort Bend	70,270	70,281	70,292	70,470	70,508	70,549	70,592	70,633	70,677	70,721	70,768
Galveston	41,582	41,630	41,679	41,727	41,788	41,852	41,920	41,990	42,064	42,141	42,221
Harris	405,627	405,757	405,866	406,271	406,568	406,879	407,185	407,503	407,849	408,213	408,588
Hidalgo	94,099	94,157	94,214	94,369	94,452	94,535	94,621	94,704	94,794	94,886	94,981
Johnson	20,233	20,248	20,262	20,277	20,289	20,300	20,313	20,326	20,338	20,351	20,365
Lubbock	49,641	49,661	49,681	49,701	49,725	49,750	49,777	49,806	49,837	49,870	49,906
McLennan	27,984	27,984	27,984	27,984	28,019	28,058	28,102	28,149	28,202	28,259	28,321
Montgomery	55,960	56,019	56,078	56,137	56,183	56,231	56,279	56,330	56,380	56,434	56,489
Tarrant	264,299	264,354	264,500	264,652	264,742	264,834	264,927	265,023	265,115	265,211	265,308
Travis	85,227	85,256	85,284	85,486	85,550	85,615	85,685	85,758	85,832	85,911	85,993
Williamson	47,623	47,679	47,735	47,927	47,974	48,022	48,072	48,126	48,182	48,240	48,303

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:		
	7/10	7/11	7/12	7/13	7/15	7/17	7/19
Bexar	228,638	228,638	228,638	228,638	228,779 (45,756) [10,981] {5,491}	228,906 (45,781) [10,987] {5,494}	229,028 (45,806) [10,993] {5,497}
Brazoria	39,053	39,079	39,106	39,132	39,210 (7,842) [1,882] {941}	39,294 (7,859) [1,886] {943}	39,385 (7,877) [1,890] {945}
Brazos	28,131	28,138	28,145	28,173	28,198 (5,640) [1,353] {677}	28,223 (5,645) [1,355] {677}	28,248 (5,650) [1,356] {678}
Collin	93,517	93,545	93,698	93,727	93,861 (18,772) [4,505] {2,253}	94,006 (18,801) [4,512] {2,256}	94,160 (18,832) [4,520] {2,260}
Dallas	307,963	308,025	308,087	308,087	308,383 (61,677) [14,802] {7,401}	308,694 (61,739) [14,817] {7,409}	309,012 (61,802) [14,833] {7,416}
Denton	77,462	77,509	77,556	77,665	77,782 (15,556) [3,734] {1,867}	77,904 (15,581) [3,739] {1,870}	78,035 (15,607) [3,746] {1,873}
El Paso	136,869	136,889	136,901	136,964	137,028 (27,406) [6,577] {3,289}	137,098 (27,420) [6,581] {3,290}	137,172 (27,434) [6,584] {3,292}
Ellis	23,131	23,143	23,155	23,167	23,186 (4,637) [1,113] {556}	23,206 (4,641) [1,114] {557}	23,224 (4,645) [1,115] {557}
Fort Bend	70,270	70,281	70,292	70,470	70,549 (14,110) [3,386] {1,693}	70,633 (14,127) [3,390] {1,695}	70,721 (14,144) [3,395] {1,697}
Galveston	41,582	41,630	41,679	41,727	41,852 (8,370) [2,009] {1,004}	41,990 (8,398) [2,016] {1,008}	42,141 (8,428) [2,023] {1,011}
Harris	405,627	405,757	405,866	406,271	406,879 (81,376) [19,530] {9,765}	407,503 (81,501) [19,560] {9,780}	408,213 (81,643) [19,594] {9,797}
Hidalgo	94,099	94,157	94,214	94,369	94,535 (18,907) [4,538] {2,269}	94,704 (18,941) [4,546] {2,273}	94,886 (18,977) [4,555] {2,277}
Johnson	20,233	20,248	20,262	20,277	20,300 (4,060) [974] {487}	20,326 (4,065) [976] {488}	20,351 (4,070) [977] {488}
Lubbock	49,641	49,661	49,681	49,701	49,750 (9,950) [2,388] {1,194}	49,806 (9,961) [2,391] {1,195}	49,870 (9,974) [2,394] {1,197}
McLennan	27,984	27,984	27,984	27,984	28,058 (5,612) [1,347] {673}	28,149 (5,630) [1,351] {676}	28,259 (5,652) [1,356] {678}
Montgomery	55,960	56,019	56,078	56,137	56,231 (11,246) [2,699] {1,350}	56,330 (11,266) [2,704] {1,352}	56,434 (11,287) [2,709] {1,354}
Tarrant	264,299	264,354	264,500	264,652	264,834 (52,967) [12,712] {6,356}	265,023 (53,005) [12,721] {6,361}	265,211 (53,042) [12,730] {6,365}
Travis	85,227	85,256	85,284	85,486	85,615 (17,123) [4,110] {2,055}	85,758 (17,152) [4,116] {2,058}	85,911 (17,182) [4,124] {2,062}
Williamson	47,623	47,679	47,735	47,927	48,022 (9,604) [2,305] {1,153}	48,126 (9,625) [2,310] {1,155}	48,240 (9,648) [2,316] {1,158}

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.