IEM's AI Modeling: Short-term COVID-19 Projections
Date: 10/20/20

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 10/20/20 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
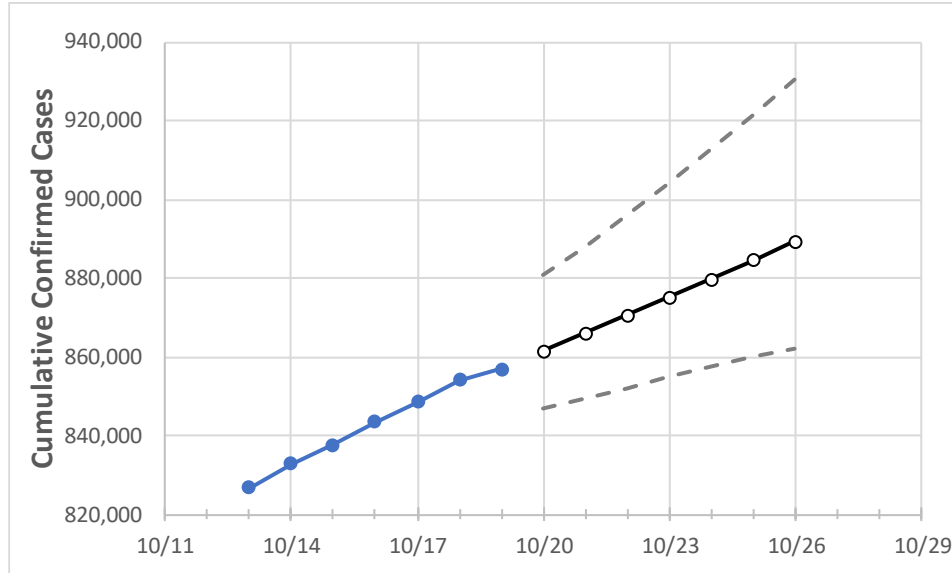
	Actual Confirmed Cases On:				Projected Cases For:						
	10/16	10/17	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26
Texas	843,487	848,442	854,006	856,948	861,438	865,966	870,531	875,135	879,775	884,454	889,170

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:						
	10/16	10/17	10/18	10/19	10/20	10/21	10/22	10/23	10/24	10/25	10/26
Bexar	60,442	60,629	63,328	63,426	63,630	63,839	64,055	64,276	64,504	64,738	64,978
Brazoria	11,917	11,954	11,981	12,008	12,036	12,064	12,093	12,121	12,149	12,177	12,204
Brazos	7,213	7,262	7,291	7,317	7,351	7,384	7,418	7,450	7,483	7,515	7,547
Collin	16,751	16,862	16,937	16,937	17,044	17,154	17,266	17,380	17,497	17,616	17,738
Dallas	88,903	89,433	89,987	90,318	90,670	91,027	91,387	91,751	92,120	92,493	92,869
Denton	13,463	13,547	13,547	13,547	13,615	13,684	13,754	13,826	13,898	13,972	14,047
El Paso	31,478	32,060	32,758	33,326	34,155	35,038	35,979	36,980	38,045	39,179	40,384
Ellis	4,700	4,729	4,729	4,729	4,748	4,767	4,788	4,810	4,834	4,859	4,886
Fort Bend	17,062	17,126	17,142	17,157	17,182	17,206	17,231	17,255	17,279	17,303	17,326
Galveston	12,015	12,046	12,090	12,090	12,102	12,114	12,126	12,137	12,149	12,160	12,170
Harris	153,571	153,955	154,367	154,765	155,168	155,566	155,958	156,344	156,725	157,101	157,472
Hidalgo	34,179	34,179	34,179	34,179	34,287	34,396	34,506	34,618	34,732	34,848	34,966
Johnson	3,384	3,426	3,426	3,426	3,440	3,454	3,469	3,483	3,497	3,511	3,525
Lubbock	14,921	15,174	15,401	15,626	15,919	16,226	16,547	16,883	17,234	17,601	17,984
McLennan	9,243	9,290	9,399	9,431	9,483	9,534	9,586	9,636	9,687	9,737	9,786
Montgomery	12,844	12,893	12,942	12,991	13,066	13,140	13,213	13,284	13,355	13,424	13,492
Tarrant	58,053	58,773	59,274	59,662	60,294	60,946	61,620	62,316	63,034	63,776	64,541
Travis	30,797	30,908	30,956	31,053	31,141	31,230	31,320	31,411	31,504	31,599	31,694
Williamson	9,137	9,137	9,137	9,137	9,162	9,188	9,214	9,240	9,266	9,292	9,319

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:		
	10/16	10/17	10/18	10/19	10/21	10/23	10/25
Bexar	60,442	60,629	63,328	63,426	63,839 (12,768) [3,064] {1,532}	64,276 (12,855) [3,085] {1,543}	64,738 (12,948) [3,107] {1,554}
Brazoria	11,917	11,954	11,981	12,008	12,064 (2,413) [579] {290}	12,121 (2,424) [582] {291}	12,177 (2,435) [584] {292}
Brazos	7,213	7,262	7,291	7,317	7,384 (1,477) [354] {177}	7,450 (1,490) [358] {179}	7,515 (1,503) [361] {180}
Collin	16,751	16,862	16,937	16,937	17,154 (3,431) [823] {412}	17,380 (3,476) [834] {417}	17,616 (3,523) [846] {423}
Dallas	88,903	89,433	89,987	90,318	91,027 (18,205) [4,369] {2,185}	91,751 (18,350) [4,404] {2,202}	92,493 (18,499) [4,440] {2,220}
Denton	13,463	13,547	13,547	13,547	13,684 (2,737) [657] {328}	13,826 (2,765) [664] {332}	13,972 (2,794) [671] {335}
El Paso	31,478	32,060	32,758	33,326	35,038 (7,008) [1,682] {841}	36,980 (7,396) [1,775] {888}	39,179 (7,836) [1,881] {940}
Ellis	4,700	4,729	4,729	4,729	4,767 (953) [229] {114}	4,810 (962) [231] {115}	4,859 (972) [233] {117}
Fort Bend	17,062	17,126	17,142	17,157	17,206 (3,441) [826] {413}	17,255 (3,451) [828] {414}	17,303 (3,461) [831] {415}
Galveston	12,015	12,046	12,090	12,090	12,114 (2,423) [581] {291}	12,137 (2,427) [583] {291}	12,160 (2,432) [584] {292}
Harris	153,571	153,955	154,367	154,765	155,566 (31,113) [7,467] {3,734}	156,344 (31,269) [7,505] {3,752}	157,101 (31,420) [7,541] {3,770}
Hidalgo	34,179	34,179	34,179	34,179	34,396 (6,879) [1,651] {825}	34,618 (6,924) [1,662] {831}	34,848 (6,970) [1,673] {836}
Johnson	3,384	3,426	3,426	3,426	3,454 (691) [166] {83}	3,483 (697) [167] {84}	3,511 (702) [169] {84}
Lubbock	14,921	15,174	15,401	15,626	16,226 (3,245) [779] {389}	16,883 (3,377) [810] {405}	17,601 (3,520) [845] {422}
McLennan	9,243	9,290	9,399	9,431	9,534 (1,907) [458] {229}	9,636 (1,927) [463] {231}	9,737 (1,947) [467] {234}
Montgomery	12,844	12,893	12,942	12,991	13,140 (2,628) [631] {315}	13,284 (2,657) [638] {319}	13,424 (2,685) [644] {322}
Tarrant	58,053	58,773	59,274	59,662	60,946 (12,189) [2,925] {1,463}	62,316 (12,463) [2,991] {1,496}	63,776 (12,755) [3,061] {1,531}
Travis	30,797	30,908	30,956	31,053	31,230 (6,246) [1,499] {750}	31,411 (6,282) [1,508] {754}	31,599 (6,320) [1,517] {758}
Williamson	9,137	9,137	9,137	9,137	9,188 (1,838) [441] {221}	9,240 (1,848) [444] {222}	9,292 (1,858) [446] {223}

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.