IEM's AI Modeling: Short-term COVID-19 Projections

Date: 7/20/20

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 20%, and are often within 10%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 7/20/20 11 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.

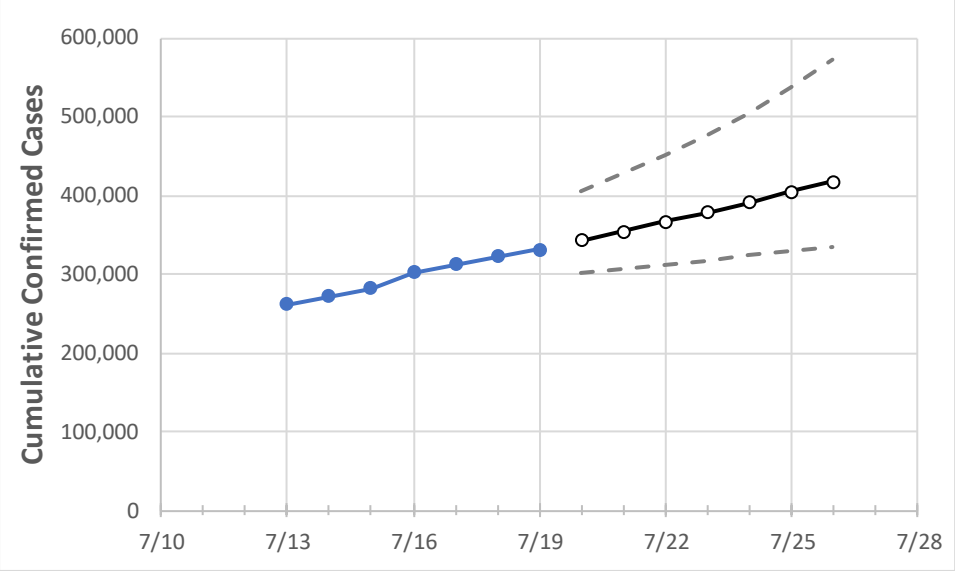
IEM's Modeling Lead

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:						
	7/16	7/17	7/18	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26
Texas	301,789	311,694	322,697	331,359	342,581	354,160	366,102	378,414	391,107	404,192	417,680

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:						
	7/16	7/17	7/18	7/19	7/20	7/21	7/22	7/23	7/24	7/25	7/26
Bexar	27,047	27,525	28,633	30,835	32,482	34,243	36,128	38,145	40,307	42,624	45,109
Brazoria	4,190	4,359	4,545	4,675	4,845	5,021	5,204	5,394	5,590	5,794	6,005
Brazos	3,200	3,253	3,313	3,373	3,441	3,508	3,574	3,639	3,703	3,766	3,828
Collin	4,934	5,079	5,154	5,291	5,414	5,536	5,658	5,779	5,900	6,020	6,141
Dallas	36,969	37,996	39,191	40,222	41,380	42,553	43,742	44,946	46,166	47,403	48,657
Denton	4,467	4,605	4,765	4,887	5,041	5,202	5,370	5,544	5,726	5,916	6,113
El Paso	10,638	10,843	11,132	11,573	11,886	12,202	12,521	12,844	13,169	13,498	13,830
Ellis	1,837	1,957	1,972	1,972	2,026	2,080	2,134	2,188	2,242	2,297	2,352
Fort Bend	5,284	5,371	5,689	5,979	6,165	6,367	6,584	6,820	7,074	7,349	7,647
Galveston	6,452	6,627	6,911	7,125	7,305	7,481	7,655	7,827	7,995	8,162	8,325
Harris	50,370	51,969	53,555	54,806	56,529	58,316	60,170	62,095	64,092	66,164	68,314
Hidalgo	8,593	9,244	10,492	10,943	11,313	11,695	12,089	12,497	12,919	13,355	13,806
Johnson	918	950	973	973	1,004	1,034	1,064	1,095	1,125	1,155	1,185
Lubbock	4,063	4,209	4,309	4,445	4,572	4,701	4,831	4,962	5,095	5,228	5,364
McLennan	3,005	3,096	3,210	3,291	3,386	3,482	3,579	3,676	3,773	3,872	3,971
Montgomery	4,324	4,501	4,721	4,721	4,944	5,188	5,454	5,744	6,061	6,406	6,783
Tarrant	19,871	20,433	20,907	21,195	21,727	22,268	22,817	23,374	23,939	24,513	25,096
Travis	16,570	16,983	17,215	17,454	17,824	18,189	18,549	18,904	19,253	19,597	19,936
Williamson	4,327	4,420	4,490	4,686	4,825	4,965	5,105	5,245	5,387	5,528	5,671

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:		
	7/16	7/17	7/18	7/19	7/21	7/23	7/25
Bexar	27,047	27,525	28,633	30,835	34,243 (6,849) [1,644] {822}	38,145 (7,629) [1,831] {915}	42,624 (8,525) [2,046] {1,023}
Brazoria	4,190	4,359	4,545	4,675	5,021 (1,004) [241] {121}	5,394 (1,079) [259] {129}	5,794 (1,159) [278] {139}
Brazos	3,200	3,253	3,313	3,373	3,508 (702) [168] {84}	3,639 (728) [175] {87}	3,766 (753) [181] {90}
Collin	4,934	5,079	5,154	5,291	5,536 (1,107) [266] {133}	5,779 (1,156) [277] {139}	6,020 (1,204) [289] {144}
Dallas	36,969	37,996	39,191	40,222	42,553 (8,511) [2,043] {1,021}	44,946 (8,989) [2,157] {1,079}	47,403 (9,481) [2,275] {1,138}
Denton	4,467	4,605	4,765	4,887	5,202 (1,040) [250] {125}	5,544 (1,109) [266] {133}	5,916 (1,183) [284] {142}
El Paso	10,638	10,843	11,132	11,573	12,202 (2,440) [586] {293}	12,844 (2,569) [616] {308}	13,498 (2,700) [648] {324}
Ellis	1,837	1,957	1,972	1,972	2,080 (416) [100] {50}	2,188 (438) [105] {53}	2,297 (459) [110] {55}
Fort Bend	5,284	5,371	5,689	5,979	6,367 (1,273) [306] {153}	6,820 (1,364) [327] {164}	7,349 (1,470) [353] {176}
Galveston	6,452	6,627	6,911	7,125	7,481 (1,496) [359] {180}	7,827 (1,565) [376] {188}	8,162 (1,632) [392] {196}
Harris	50,370	51,969	53,555	54,806	58,316 (11,663) [2,799] {1,400}	62,095 (12,419) [2,981] {1,490}	66,164 (13,233) [3,176] {1,588}
Hidalgo	8,593	9,244	10,492	10,943	11,695 (2,339) [561] {281}	12,497 (2,499) [600] {300}	13,355 (2,671) [641] {321}
Johnson	918	950	973	973	1,034 (207) [50] {25}	1,095 (219) [53] {26}	1,155 (231) [55] {28}
Lubbock	4,063	4,209	4,309	4,445	4,701 (940) [226] {113}	4,962 (992) [238] {119}	5,228 (1,046) [251] {125}
McLennan	3,005	3,096	3,210	3,291	3,482 (696) [167] {84}	3,676 (735) [176] {88}	3,872 (774) [186] {93}
Montgomery	4,324	4,501	4,721	4,721	5,188 (1,038) [249] {125}	5,744 (1,149) [276] {138}	6,406 (1,281) [307] {154}
Tarrant	19,871	20,433	20,907	21,195	22,268 (4,454) [1,069] {534}	23,374 (4,675) [1,122] {561}	24,513 (4,903) [1,177] {588}
Travis	16,570	16,983	17,215	17,454	18,189 (3,638) [873] {437}	18,904 (3,781) [907] {454}	19,597 (3,919) [941] {470}
Williamson	4,327	4,420	4,490	4,686	4,965 (993) [238] {119}	5,245 (1,049) [252] {126}	5,528 (1,106) [265] {133}

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.