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

Date: 9/18/20

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 9/18/20 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.

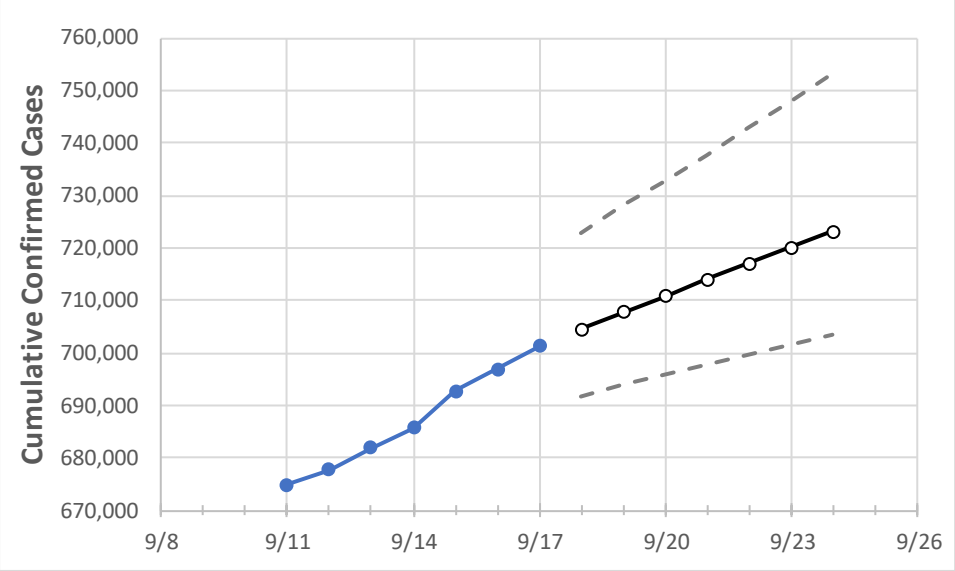
IEM's Modeling Lead

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:						
	9/14	9/15	9/16	9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24
Texas	685,748	692,753	696,807	701,350	704,543	707,711	710,852	713,968	717,056	720,119	723,156

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:						
	9/14	9/15	9/16	9/17	9/18	9/19	9/20	9/21	9/22	9/23	9/24
Bexar	50,016	50,131	50,284	50,425	50,575	50,726	50,878	51,031	51,185	51,340	51,496
Brazoria	10,633	10,721	10,772	10,872	10,944	11,015	11,087	11,158	11,229	11,300	11,371
Brazos	5,743	5,807	5,860	5,933	5,994	6,054	6,115	6,175	6,235	6,294	6,353
Collin	12,239	12,369	12,482	12,599	12,705	12,815	12,929	13,048	13,170	13,298	13,430
Dallas	75,648	75,838	76,149	76,607	76,833	77,057	77,278	77,496	77,711	77,923	78,133
Denton	11,130	11,225	11,317	11,382	11,429	11,476	11,520	11,564	11,606	11,648	11,688
El Paso	21,731	21,826	21,952	22,078	22,150	22,220	22,289	22,357	22,423	22,489	22,553
Ellis	4,079	4,119	4,136	4,181	4,200	4,220	4,239	4,258	4,277	4,296	4,315
Fort Bend	15,471	15,499	15,625	15,678	15,700	15,722	15,742	15,762	15,781	15,799	15,817
Galveston	11,301	11,337	11,360	11,402	11,435	11,467	11,500	11,532	11,564	11,596	11,627
Harris	117,568	120,336	120,771	121,628	122,317	123,004	123,689	124,371	125,051	125,728	126,402
Hidalgo	29,519	29,721	30,046	30,375	30,482	30,586	30,687	30,786	30,882	30,976	31,067
Johnson	2,687	2,699	2,711	2,739	2,748	2,756	2,765	2,773	2,781	2,789	2,797
Lubbock	9,649	9,828	9,936	10,044	10,186	10,332	10,484	10,640	10,802	10,969	11,141
McLennan	7,134	7,188	7,231	7,271	7,314	7,357	7,399	7,441	7,483	7,524	7,564
Montgomery	10,016	10,182	10,343	10,449	10,554	10,661	10,770	10,882	10,996	11,113	11,233
Tarrant	44,727	45,163	45,583	45,868	46,091	46,314	46,539	46,764	46,990	47,216	47,444
Travis	27,776	27,961	28,103	28,212	28,296	28,380	28,463	28,547	28,630	28,713	28,796
Williamson	8,227	8,252	8,296	8,331	8,353	8,376	8,398	8,421	8,444	8,467	8,491

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:		
	9/14	9/15	9/16	9/17	9/19	9/21	9/23
Bexar	50,016	50,131	50,284	50,425	50,726 (10,145) [2,435] {1,217}	51,031 (10,206) [2,449] {1,225}	51,340 (10,268) [2,464] {1,232}
Brazoria	10,633	10,721	10,772	10,872	11,015 (2,203) [529] {264}	11,158 (2,232) [536] {268}	11,300 (2,260) [542] {271}
Brazos	5,743	5,807	5,860	5,933	6,054 (1,211) [291] {145}	6,175 (1,235) [296] {148}	6,294 (1,259) [302] {151}
Collin	12,239	12,369	12,482	12,599	12,815 (2,563) [615] {308}	13,048 (2,610) [626] {313}	13,298 (2,660) [638] {319}
Dallas	75,648	75,838	76,149	76,607	77,057 (15,411) [3,699] {1,849}	77,496 (15,499) [3,720] {1,860}	77,923 (15,585) [3,740] {1,870}
Denton	11,130	11,225	11,317	11,382	11,476 (2,295) [551] {275}	11,564 (2,313) [555] {278}	11,648 (2,330) [559] {280}
El Paso	21,731	21,826	21,952	22,078	22,220 (4,444) [1,067] {533}	22,357 (4,471) [1,073] {537}	22,489 (4,498) [1,079] {540}
Ellis	4,079	4,119	4,136	4,181	4,220 (844) [203] {101}	4,258 (852) [204] {102}	4,296 (859) [206] {103}
Fort Bend	15,471	15,499	15,625	15,678	15,722 (3,144) [755] {377}	15,762 (3,152) [757] {378}	15,799 (3,160) [758] {379}
Galveston	11,301	11,337	11,360	11,402	11,467 (2,293) [550] {275}	11,532 (2,306) [554] {277}	11,596 (2,319) [557] {278}
Harris	117,568	120,336	120,771	121,628	123,004 (24,601) [5,904] {2,952}	124,371 (24,874) [5,970] {2,985}	125,728 (25,146) [6,035] {3,017}
Hidalgo	29,519	29,721	30,046	30,375	30,586 (6,117) [1,468] {734}	30,786 (6,157) [1,478] {739}	30,976 (6,195) [1,487] {743}
Johnson	2,687	2,699	2,711	2,739	2,756 (551) [132] {66}	2,773 (555) [133] {67}	2,789 (558) [134] {67}
Lubbock	9,649	9,828	9,936	10,044	10,332 (2,066) [496] {248}	10,640 (2,128) [511] {255}	10,969 (2,194) [527] {263}
McLennan	7,134	7,188	7,231	7,271	7,357 (1,471) [353] {177}	7,441 (1,488) [357] {179}	7,524 (1,505) [361] {181}
Montgomery	10,016	10,182	10,343	10,449	10,661 (2,132) [512] {256}	10,882 (2,176) [522] {261}	11,113 (2,223) [533] {267}
Tarrant	44,727	45,163	45,583	45,868	46,314 (9,263) [2,223] {1,112}	46,764 (9,353) [2,245] {1,122}	47,216 (9,443) [2,266] {1,133}
Travis	27,776	27,961	28,103	28,212	28,380 (5,676) [1,362] {681}	28,547 (5,709) [1,370] {685}	28,713 (5,743) [1,378] {689}
Williamson	8,227	8,252	8,296	8,331	8,376 (1,675) [402] {201}	8,421 (1,684) [404] {202}	8,467 (1,693) [406] {203}

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.