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

Date: 8/5/20

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 8/5/20 12 p.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.

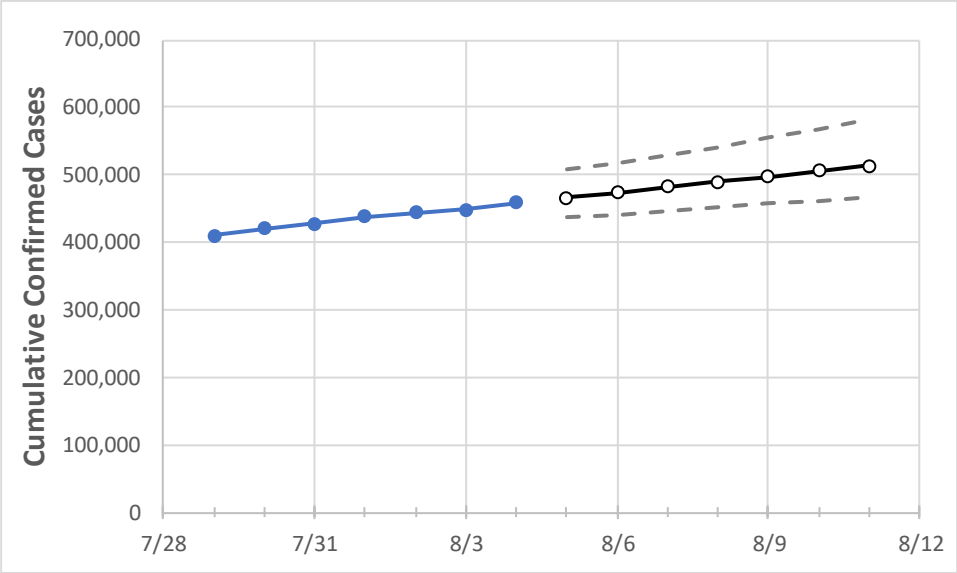
IEM's Modeling Lead

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:						
	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10	8/11
Texas	437,684	443,356	449,028	458,299	466,118	473,980	481,884	489,830	497,818	505,847	513,916

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:						
	8/1	8/2	8/3	8/4	8/5	8/6	8/7	8/8	8/9	8/10	8/11
Bexar	41,138	41,183	41,229	41,274	41,518	41,752	41,977	42,194	42,403	42,603	42,796
Brazoria	6,534	6,633	6,732	6,732	6,870	7,011	7,155	7,302	7,451	7,603	7,758
Brazos	3,877	3,900	3,922	3,936	3,958	3,979	4,000	4,020	4,040	4,059	4,077
Collin	6,353	6,378	6,403	6,421	6,456	6,489	6,522	6,553	6,583	6,612	6,640
Dallas	49,976	50,542	51,108	51,490	52,061	52,626	53,186	53,739	54,287	54,830	55,366
Denton	6,803	6,871	6,938	7,032	7,153	7,275	7,398	7,523	7,648	7,774	7,901
El Paso	14,410	14,662	14,914	15,142	15,347	15,552	15,757	15,961	16,165	16,368	16,571
Ellis	2,472	2,496	2,521	2,545	2,569	2,592	2,615	2,638	2,660	2,682	2,703
Fort Bend	7,082	7,137	7,191	7,287	7,372	7,459	7,548	7,638	7,730	7,824	7,919
Galveston	8,721	8,773	8,825	8,999	9,087	9,172	9,257	9,339	9,419	9,498	9,576
Harris	72,964	74,803	76,642	78,105	79,761	81,452	83,176	84,936	86,731	88,562	90,429
Hidalgo	17,006	17,180	17,353	17,751	18,062	18,378	18,700	19,028	19,362	19,702	20,047
Johnson	1,541	1,567	1,593	1,619	1,658	1,698	1,739	1,781	1,823	1,867	1,911
Lubbock	5,512	5,553	5,593	5,652	5,711	5,770	5,828	5,885	5,942	5,998	6,053
McLennan	4,326	4,381	4,436	4,571	4,636	4,701	4,767	4,834	4,901	4,968	5,036
Montgomery	6,196	6,228	6,259	6,291	6,361	6,430	6,500	6,569	6,638	6,707	6,775
Tarrant	28,410	28,732	29,054	29,357	29,827	30,300	30,776	31,255	31,738	32,224	32,713
Travis	20,745	20,980	21,214	21,549	21,749	21,946	22,141	22,333	22,523	22,710	22,894
Williamson	5,715	5,754	5,793	5,832	5,882	5,931	5,980	6,027	6,074	6,119	6,164

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:		
	8/1	8/2	8/3	8/4	8/6	8/8	8/10
Bexar	41,138	41,183	41,229	41,274	41,752 (8,350) [2,004] {1,002}	42,194 (8,439) [2,025] {1,013}	42,603 (8,521) [2,045] {1,022}
Brazoria	6,534	6,633	6,732	6,732	7,011 (1,402) [337] {168}	7,302 (1,460) [350] {175}	7,603 (1,521) [365] {182}
Brazos	3,877	3,900	3,922	3,936	3,979 (796) [191] {96}	4,020 (804) [193] {96}	4,059 (812) [195] {97}
Collin	6,353	6,378	6,403	6,421	6,489 (1,298) [311] {156}	6,553 (1,311) [315] {157}	6,612 (1,322) [317] {159}
Dallas	49,976	50,542	51,108	51,490	52,626 (10,525) [2,526] {1,263}	53,739 (10,748) [2,579] {1,290}	54,830 (10,966) [2,632] {1,316}
Denton	6,803	6,871	6,938	7,032	7,275 (1,455) [349] {175}	7,523 (1,505) [361] {181}	7,774 (1,555) [373] {187}
El Paso	14,410	14,662	14,914	15,142	15,552 (3,110) [747] {373}	15,961 (3,192) [766] {383}	16,368 (3,274) [786] {393}
Ellis	2,472	2,496	2,521	2,545	2,592 (518) [124] {62}	2,638 (528) [127] {63}	2,682 (536) [129] {64}
Fort Bend	7,082	7,137	7,191	7,287	7,459 (1,492) [358] {179}	7,638 (1,528) [367] {183}	7,824 (1,565) [376] {188}
Galveston	8,721	8,773	8,825	8,999	9,172 (1,834) [440] {220}	9,339 (1,868) [448] {224}	9,498 (1,900) [456] {228}
Harris	72,964	74,803	76,642	78,105	81,452 (16,290) [3,910] {1,955}	84,936 (16,987) [4,077] {2,038}	88,562 (17,712) [4,251] {2,125}
Hidalgo	17,006	17,180	17,353	17,751	18,378 (3,676) [882] {441}	19,028 (3,806) [913] {457}	19,702 (3,940) [946] {473}
Johnson	1,541	1,567	1,593	1,619	1,698 (340) [82] {41}	1,781 (356) [85] {43}	1,867 (373) [90] {45}
Lubbock	5,512	5,553	5,593	5,652	5,770 (1,154) [277] {138}	5,885 (1,177) [282] {141}	5,998 (1,200) [288] {144}
McLennan	4,326	4,381	4,436	4,571	4,701 (940) [226] {113}	4,834 (967) [232] {116}	4,968 (994) [238] {119}
Montgomery	6,196	6,228	6,259	6,291	6,430 (1,286) [309] {154}	6,569 (1,314) [315] {158}	6,707 (1,341) [322] {161}
Tarrant	28,410	28,732	29,054	29,357	30,300 (6,060) [1,454] {727}	31,255 (6,251) [1,500] {750}	32,224 (6,445) [1,547] {773}
Travis	20,745	20,980	21,214	21,549	21,946 (4,389) [1,053] {527}	22,333 (4,467) [1,072] {536}	22,710 (4,542) [1,090] {545}
Williamson	5,715	5,754	5,793	5,832	5,931 (1,186) [285] {142}	6,027 (1,205) [289] {145}	6,119 (1,224) [294] {147}

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.