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

Date: 2/24/21

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 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 2/24/21 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.

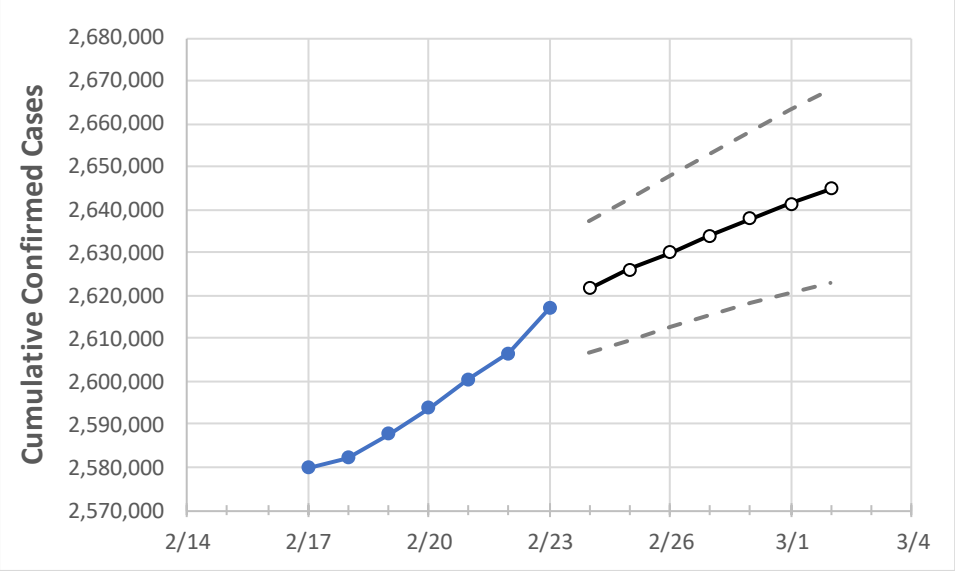
IEM's Modeling Lead

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:						
	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2
Texas	2,593,816	2,600,660	2,606,513	2,617,096	2,621,699	2,626,021	2,630,129	2,634,086	2,637,995	2,641,506	2,644,965

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:						
	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	3/1	3/2
Bexar	189,963	193,461	193,691	193,961	194,535	195,088	195,629	196,178	196,708	197,240	197,751
Brazoria	31,368	31,704	31,684	32,047	32,169	32,297	32,425	32,552	32,675	32,799	32,927
Brazos	20,307	20,331	20,441	20,550	20,585	20,619	20,651	20,682	20,712	20,742	20,769
Collin	81,130	81,208	81,392	81,702	81,891	82,069	82,227	82,381	82,527	82,668	82,799
Dallas	276,672	276,945	277,325	277,705	278,009	278,291	278,536	278,765	278,977	279,174	279,351
Denton	60,936	61,046	61,156	61,991	62,203	62,409	62,604	62,801	62,987	63,177	63,368
El Paso	120,982	121,503	121,765	122,394	122,709	123,021	123,330	123,630	123,923	124,220	124,511
Ellis	20,406	20,428	20,451	20,473	20,507	20,539	20,569	20,597	20,622	20,646	20,669
Fort Bend	56,104	56,435	56,765	56,897	57,048	57,200	57,341	57,483	57,611	57,734	57,855
Galveston	33,562	33,666	33,666	33,666	33,737	33,811	33,876	33,941	34,002	34,060	34,114
Harris	340,951	342,309	343,070	343,573	344,220	344,852	345,445	345,989	346,520	347,059	347,585
Hidalgo	72,957	73,191	73,425	74,041	74,305	74,558	74,807	75,046	75,274	75,494	75,718
Johnson	18,227	18,244	18,260	18,277	18,316	18,352	18,385	18,417	18,448	18,474	18,501
Lubbock	47,954	47,976	47,984	48,002	48,027	48,049	48,071	48,092	48,111	48,129	48,147
McLennan	24,542	24,610	24,679	24,747	24,804	24,860	24,916	24,970	25,026	25,077	25,129
Montgomery	44,155	44,251	44,346	44,439	44,545	44,638	44,726	44,809	44,890	44,962	45,030
Tarrant	238,077	238,449	238,820	239,188	239,530	239,867	240,183	240,481	240,774	241,044	241,304
Travis	73,779	73,809	74,206	74,598	74,685	74,769	74,846	74,920	74,988	75,049	75,110
Williamson	39,586	39,586	39,586	39,586	39,792	40,000	40,201	40,409	40,614	40,806	40,994

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:		
	2/20	2/21	2/22	2/23	2/25	2/27	3/1
Bexar	189,963	193,461	193,691	193,961	195,088 (39,018) [9,364] {4,682}	196,178 (39,236) [9,417] {4,708}	197,240 (39,448) [9,468] {4,734}
Brazoria	31,368	31,704	31,684	32,047	32,297 (6,459) [1,550] {775}	32,552 (6,510) [1,562] {781}	32,799 (6,560) [1,574] {787}
Brazos	20,307	20,331	20,441	20,550	20,619 (4,124) [990] {495}	20,682 (4,136) [993] {496}	20,742 (4,148) [996] {498}
Collin	81,130	81,208	81,392	81,702	82,069 (16,414) [3,939] {1,970}	82,381 (16,476) [3,954] {1,977}	82,668 (16,534) [3,968] {1,984}
Dallas	276,672	276,945	277,325	277,705	278,291 (55,658) [13,358] {6,679}	278,765 (55,753) [13,381] {6,690}	279,174 (55,835) [13,400] {6,700}
Denton	60,936	61,046	61,156	61,991	62,409 (12,482) [2,996] {1,498}	62,801 (12,560) [3,014] {1,507}	63,177 (12,635) [3,032] {1,516}
El Paso	120,982	121,503	121,765	122,394	123,021 (24,604) [5,905] {2,952}	123,630 (24,726) [5,934] {2,967}	124,220 (24,844) [5,963] {2,981}
Ellis	20,406	20,428	20,451	20,473	20,539 (4,108) [986] {493}	20,597 (4,119) [989] {494}	20,646 (4,129) [991] {496}
Fort Bend	56,104	56,435	56,765	56,897	57,200 (11,440) [2,746] {1,373}	57,483 (11,497) [2,759] {1,380}	57,734 (11,547) [2,771] {1,386}
Galveston	33,562	33,666	33,666	33,666	33,811 (6,762) [1,623] {811}	33,941 (6,788) [1,629] {815}	34,060 (6,812) [1,635] {817}
Harris	340,951	342,309	343,070	343,573	344,852 (68,970) [16,553] {8,276}	345,989 (69,198) [16,607] {8,304}	347,059 (69,412) [16,659] {8,329}
Hidalgo	72,957	73,191	73,425	74,041	74,558 (14,912) [3,579] {1,789}	75,046 (15,009) [3,602] {1,801}	75,494 (15,099) [3,624] {1,812}
Johnson	18,227	18,244	18,260	18,277	18,352 (3,670) [881] {440}	18,417 (3,683) [884] {442}	18,474 (3,695) [887] {443}
Lubbock	47,954	47,976	47,984	48,002	48,049 (9,610) [2,306] {1,153}	48,092 (9,618) [2,308] {1,154}	48,129 (9,626) [2,310] {1,155}
McLennan	24,542	24,610	24,679	24,747	24,860 (4,972) [1,193] {597}	24,970 (4,994) [1,199] {599}	25,077 (5,015) [1,204] {602}
Montgomery	44,155	44,251	44,346	44,439	44,638 (8,928) [2,143] {1,071}	44,809 (8,962) [2,151] {1,075}	44,962 (8,992) [2,158] {1,079}
Tarrant	238,077	238,449	238,820	239,188	239,867 (47,973) [11,514] {5,757}	240,481 (48,096) [11,543] {5,772}	241,044 (48,209) [11,570] {5,785}
Travis	73,779	73,809	74,206	74,598	74,769 (14,954) [3,589] {1,794}	74,920 (14,984) [3,596] {1,798}	75,049 (15,010) [3,602] {1,801}
Williamson	39,586	39,586	39,586	39,586	40,000 (8,000) [1,920] {960}	40,409 (8,082) [1,940] {970}	40,806 (8,161) [1,959] {979}

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.