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

Date: 4/20/21

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 4/20/21 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.

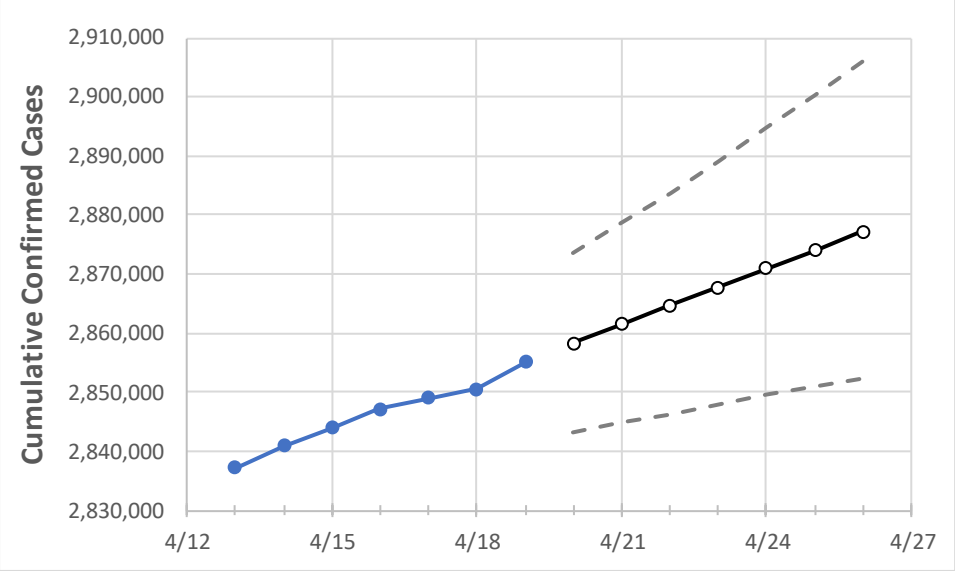
IEM's Modeling Lead

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:						
	4/16	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26
Texas	2,847,101	2,849,072	2,850,575	2,855,052	2,858,282	2,861,505	2,864,669	2,867,806	2,870,944	2,874,028	2,877,210

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:						
	4/16	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26
Bexar	211,422	212,174	212,925	213,677	214,144	214,623	215,106	215,619	216,158	216,676	217,229
Brazoria	36,473	36,530	36,587	36,650	36,709	36,766	36,829	36,888	36,949	37,007	37,067
Brazos	25,770	25,879	25,879	25,879	25,926	25,977	26,026	26,075	26,124	26,171	26,222
Collin	88,244	88,361	88,478	88,563	88,670	88,774	88,883	88,990	89,098	89,206	89,318
Dallas	295,251	295,543	295,543	295,543	295,760	295,966	296,181	296,392	296,594	296,801	297,000
Denton	73,207	73,279	73,352	73,424	73,509	73,594	73,680	73,766	73,851	73,940	74,029
El Paso	132,038	132,132	132,355	132,448	132,587	132,731	132,870	133,009	133,148	133,290	133,422
Ellis	22,359	22,368	22,368	22,368	22,386	22,404	22,422	22,440	22,458	22,477	22,496
Fort Bend	65,424	65,435	65,447	65,458	65,551	65,650	65,739	65,829	65,919	66,015	66,111
Galveston	38,128	38,158	38,196	38,196	38,252	38,308	38,363	38,417	38,470	38,524	38,578
Harris	385,448	385,924	386,436	386,620	387,050	387,476	387,878	388,285	388,677	389,072	389,459
Hidalgo	86,969	87,032	87,096	87,159	87,278	87,397	87,523	87,644	87,762	87,886	88,008
Johnson	19,498	19,503	19,503	19,503	19,511	19,518	19,526	19,533	19,539	19,546	19,552
Lubbock	48,733	48,741	48,741	48,741	48,748	48,754	48,761	48,767	48,774	48,780	48,786
McLennan	26,499	26,528	26,528	26,528	26,553	26,578	26,603	26,628	26,654	26,679	26,704
Montgomery	50,976	51,059	51,141	51,224	51,315	51,405	51,493	51,581	51,668	51,754	51,839
Tarrant	254,188	254,306	254,424	254,723	254,957	255,192	255,437	255,675	255,910	256,159	256,416
Travis	81,002	81,138	81,199	81,342	81,470	81,601	81,731	81,860	81,994	82,126	82,259
Williamson	44,346	44,405	44,464	44,523	44,601	44,681	44,759	44,838	44,918	44,996	45,076

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:		
	4/16	4/17	4/18	4/19	4/21	4/23	4/25
Bexar	211,422	212,174	212,925	213,677	214,623 (42,925) [10,302] {5,151}	215,619 (43,124) [10,350] {5,175}	216,676 (43,335) [10,400] {5,200}
Brazoria	36,473	36,530	36,587	36,650	36,766 (7,353) [1,765] {882}	36,888 (7,378) [1,771] {885}	37,007 (7,401) [1,776] {888}
Brazos	25,770	25,879	25,879	25,879	25,977 (5,195) [1,247] {623}	26,075 (5,215) [1,252] {626}	26,171 (5,234) [1,256] {628}
Collin	88,244	88,361	88,478	88,563	88,774 (17,755) [4,261] {2,131}	88,990 (17,798) [4,272] {2,136}	89,206 (17,841) [4,282] {2,141}
Dallas	295,251	295,543	295,543	295,543	295,966 (59,193) [14,206] {7,103}	296,392 (59,278) [14,227] {7,113}	296,801 (59,360) [14,246] {7,123}
Denton	73,207	73,279	73,352	73,424	73,594 (14,719) [3,532] {1,766}	73,766 (14,753) [3,541] {1,770}	73,940 (14,788) [3,549] {1,775}
El Paso	132,038	132,132	132,355	132,448	132,731 (26,546) [6,371] {3,186}	133,009 (26,602) [6,384] {3,192}	133,290 (26,658) [6,398] {3,199}
Ellis	22,359	22,368	22,368	22,368	22,404 (4,481) [1,075] {538}	22,440 (4,488) [1,077] {539}	22,477 (4,495) [1,079] {539}
Fort Bend	65,424	65,435	65,447	65,458	65,650 (13,130) [3,151] {1,576}	65,829 (13,166) [3,160] {1,580}	66,015 (13,203) [3,169] {1,584}
Galveston	38,128	38,158	38,196	38,196	38,308 (7,662) [1,839] {919}	38,417 (7,683) [1,844] {922}	38,524 (7,705) [1,849] {925}
Harris	385,448	385,924	386,436	386,620	387,476 (77,495) [18,599] {9,299}	388,285 (77,657) [18,638] {9,319}	389,072 (77,814) [18,675] {9,338}
Hidalgo	86,969	87,032	87,096	87,159	87,397 (17,479) [4,195] {2,098}	87,644 (17,529) [4,207] {2,103}	87,886 (17,577) [4,219] {2,109}
Johnson	19,498	19,503	19,503	19,503	19,518 (3,904) [937] {468}	19,533 (3,907) [938] {469}	19,546 (3,909) [938] {469}
Lubbock	48,733	48,741	48,741	48,741	48,754 (9,751) [2,340] {1,170}	48,767 (9,753) [2,341] {1,170}	48,780 (9,756) [2,341] {1,171}
McLennan	26,499	26,528	26,528	26,528	26,578 (5,316) [1,276] {638}	26,628 (5,326) [1,278] {639}	26,679 (5,336) [1,281] {640}
Montgomery	50,976	51,059	51,141	51,224	51,405 (10,281) [2,467] {1,234}	51,581 (10,316) [2,476] {1,238}	51,754 (10,351) [2,484] {1,242}
Tarrant	254,188	254,306	254,424	254,723	255,192 (51,038) [12,249] {6,125}	255,675 (51,135) [12,272] {6,136}	256,159 (51,232) [12,296] {6,148}
Travis	81,002	81,138	81,199	81,342	81,601 (16,320) [3,917] {1,958}	81,860 (16,372) [3,929] {1,965}	82,126 (16,425) [3,942] {1,971}
Williamson	44,346	44,405	44,464	44,523	44,681 (8,936) [2,145] {1,072}	44,838 (8,968) [2,152] {1,076}	44,996 (8,999) [2,160] {1,080}

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.