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

Date: 3/8/22

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 3/8/22 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.

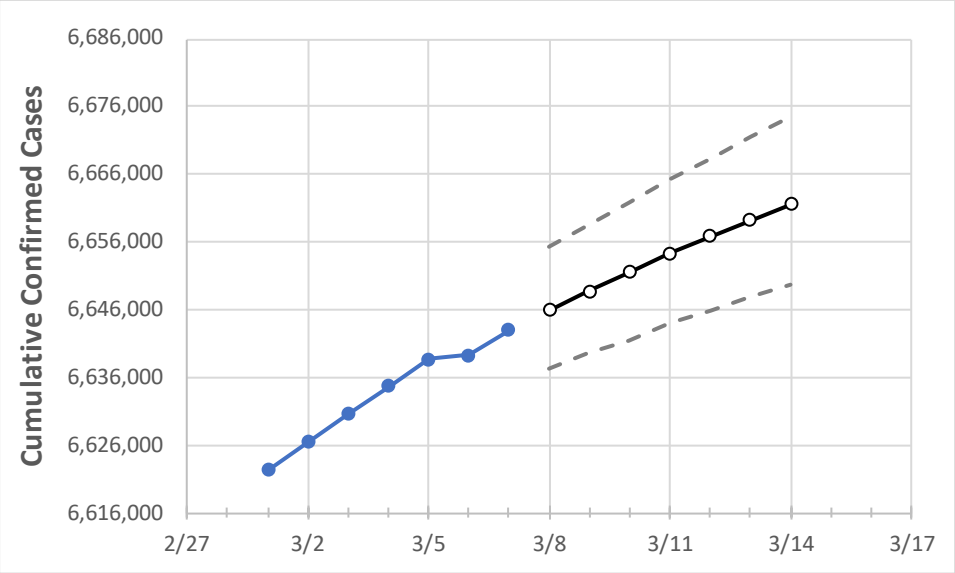
IEM's Modeling Lead

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:						
	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14
Texas	6,634,694	6,638,712	6,639,270	6,642,949	6,645,895	6,648,777	6,651,511	6,654,288	6,656,805	6,659,163	6,661,628

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:						
	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11	3/12	3/13	3/14
Bexar	545,690	546,153	546,207	546,405	546,675	546,940	547,175	547,421	547,645	547,870	548,080
Brazoria	92,744	92,805	92,820	92,845	92,869	92,890	92,910	92,928	92,947	92,964	92,981
Brazos	59,711	59,727	59,735	59,753	59,767	59,780	59,792	59,803	59,815	59,825	59,835
Collin	204,123	204,341	204,356	204,432	204,552	204,662	204,770	204,873	204,972	205,076	205,175
Dallas	565,678	565,830	565,847	566,011	566,167	566,300	566,412	566,517	566,630	566,765	566,866
Denton	176,700	176,736	176,771	176,807	176,888	176,954	177,022	177,085	177,145	177,206	177,262
El Paso	203,510	203,570	203,590	203,703	203,755	203,805	203,853	203,899	203,945	203,988	204,027
Ellis	48,369	48,391	48,393	48,398	48,422	48,452	48,475	48,498	48,522	48,548	48,567
Fort Bend	177,233	177,561	177,589	177,660	177,799	177,925	178,044	178,163	178,289	178,405	178,506
Galveston	94,716	94,735	94,748	94,822	94,843	94,863	94,881	94,896	94,912	94,928	94,943
Harris	993,728	994,176	994,307	994,677	994,924	995,192	995,421	995,663	995,872	996,075	996,275
Hidalgo	194,436	194,923	194,956	195,191	195,432	195,686	195,941	196,176	196,409	196,640	196,851
Johnson	41,777	41,842	41,844	41,854	41,873	41,890	41,907	41,922	41,937	41,953	41,969
Lubbock	93,044	93,149	93,157	93,170	93,186	93,201	93,215	93,228	93,243	93,254	93,266
McLennan	56,523	56,572	56,576	56,589	56,629	56,665	56,700	56,732	56,763	56,797	56,830
Montgomery	135,546	135,593	135,606	135,628	135,669	135,710	135,747	135,786	135,821	135,853	135,887
Tarrant	559,128	559,197	559,265	559,334	559,505	559,674	559,821	559,994	560,144	560,278	560,398
Travis	219,148	219,214	219,239	219,309	219,369	219,427	219,481	219,532	219,584	219,633	219,677
Williamson	131,380	131,451	131,523	131,594	131,650	131,704	131,754	131,807	131,856	131,903	131,949

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:		
	3/4	3/5	3/6	3/7	3/9	3/11	3/13
Bexar	545,690	546,153	546,207	546,405	546,940 (109,388) [26,253] {13,127}	547,421 (109,484) [26,276] {13,138}	547,870 (109,574) [26,298] {13,149}
Brazoria	92,744	92,805	92,820	92,845	92,890 (18,578) [4,459] {2,229}	92,928 (18,586) [4,461] {2,230}	92,964 (18,593) [4,462] {2,231}
Brazos	59,711	59,727	59,735	59,753	59,780 (11,956) [2,869] {1,435}	59,803 (11,961) [2,871] {1,435}	59,825 (11,965) [2,872] {1,436}
Collin	204,123	204,341	204,356	204,432	204,662 (40,932) [9,824] {4,912}	204,873 (40,975) [9,834] {4,917}	205,076 (41,015) [9,844] {4,922}
Dallas	565,678	565,830	565,847	566,011	566,300 (113,260) [27,182] {13,591}	566,517 (113,303) [27,193] {13,596}	566,765 (113,353) [27,205] {13,602}
Denton	176,700	176,736	176,771	176,807	176,954 (35,391) [8,494] {4,247}	177,085 (35,417) [8,500] {4,250}	177,206 (35,441) [8,506] {4,253}
El Paso	203,510	203,570	203,590	203,703	203,805 (40,761) [9,783] {4,891}	203,899 (40,780) [9,787] {4,894}	203,988 (40,798) [9,791] {4,896}
Ellis	48,369	48,391	48,393	48,398	48,452 (9,690) [2,326] {1,163}	48,498 (9,700) [2,328] {1,164}	48,548 (9,710) [2,330] {1,165}
Fort Bend	177,233	177,561	177,589	177,660	177,925 (35,585) [8,540] {4,270}	178,163 (35,633) [8,552] {4,276}	178,405 (35,681) [8,563] {4,282}
Galveston	94,716	94,735	94,748	94,822	94,863 (18,973) [4,553] {2,277}	94,896 (18,979) [4,555] {2,278}	94,928 (18,986) [4,557] {2,278}
Harris	993,728	994,176	994,307	994,677	995,192 (199,038) [47,769] {23,885}	995,663 (199,133) [47,792] {23,896}	996,075 (199,215) [47,812] {23,906}
Hidalgo	194,436	194,923	194,956	195,191	195,686 (39,137) [9,393] {4,696}	196,176 (39,235) [9,416] {4,708}	196,640 (39,328) [9,439] {4,719}
Johnson	41,777	41,842	41,844	41,854	41,890 (8,378) [2,011] {1,005}	41,922 (8,384) [2,012] {1,006}	41,953 (8,391) [2,014] {1,007}
Lubbock	93,044	93,149	93,157	93,170	93,201 (18,640) [4,474] {2,237}	93,228 (18,646) [4,475] {2,237}	93,254 (18,651) [4,476] {2,238}
McLennan	56,523	56,572	56,576	56,589	56,665 (11,333) [2,720] {1,360}	56,732 (11,346) [2,723] {1,362}	56,797 (11,359) [2,726] {1,363}
Montgomery	135,546	135,593	135,606	135,628	135,710 (27,142) [6,514] {3,257}	135,786 (27,157) [6,518] {3,259}	135,853 (27,171) [6,521] {3,260}
Tarrant	559,128	559,197	559,265	559,334	559,674 (111,935) [26,864] {13,432}	559,994 (111,999) [26,880] {13,440}	560,278 (112,056) [26,893] {13,447}
Travis	219,148	219,214	219,239	219,309	219,427 (43,885) [10,532] {5,266}	219,532 (43,906) [10,538] {5,269}	219,633 (43,927) [10,542] {5,271}
Williamson	131,380	131,451	131,523	131,594	131,704 (26,341) [6,322] {3,161}	131,807 (26,361) [6,327] {3,163}	131,903 (26,381) [6,331] {3,166}

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.