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

Date: 11/1/21

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 11/1/21 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.

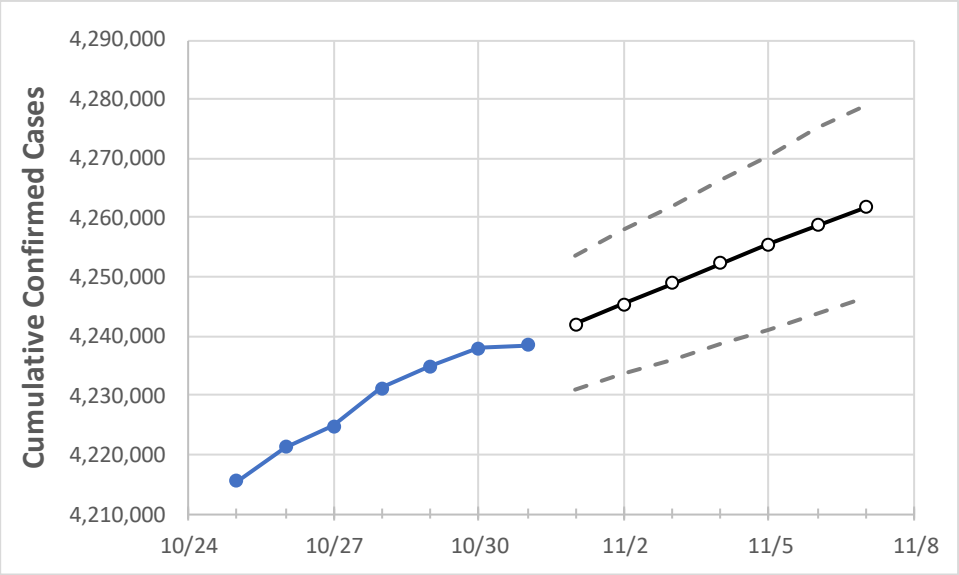
IEM's Modeling Lead

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:						
	10/28	10/29	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7
Texas	4,231,141	4,234,996	4,238,040	4,238,438	4,241,979	4,245,454	4,248,883	4,252,228	4,255,475	4,258,715	4,261,818

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:						
	10/28	10/29	10/30	10/31	11/1	11/2	11/3	11/4	11/5	11/6	11/7
Bexar	321,013	321,186	321,186	321,186	321,420	321,667	321,900	322,131	322,368	322,594	322,827
Brazoria	59,673	59,705	59,756	59,756	59,804	59,852	59,900	59,947	59,996	60,043	60,091
Brazos	38,609	38,626	38,626	38,626	38,640	38,655	38,669	38,683	38,695	38,707	38,719
Collin	129,153	129,302	129,447	129,547	129,675	129,797	129,920	130,039	130,157	130,280	130,395
Dallas	404,096	404,367	404,637	404,637	405,006	405,343	405,689	406,033	406,368	406,725	407,036
Denton	107,539	107,757	107,757	107,757	107,941	108,122	108,302	108,472	108,646	108,821	109,002
El Paso	148,833	149,080	149,326	149,520	149,727	149,935	150,152	150,378	150,609	150,840	151,073
Ellis	33,568	33,594	33,623	33,623	33,678	33,733	33,786	33,839	33,887	33,940	33,990
Fort Bend	99,990	100,062	100,062	100,062	100,174	100,301	100,401	100,520	100,614	100,745	100,861
Galveston	64,101	64,134	64,200	64,200	64,247	64,290	64,335	64,377	64,419	64,460	64,503
Harris	575,129	575,587	575,946	575,974	576,351	576,738	577,072	577,434	577,776	578,151	578,432
Hidalgo	117,676	117,782	117,782	117,782	117,880	117,981	118,081	118,187	118,287	118,394	118,500
Johnson	28,452	28,488	28,547	28,547	28,602	28,652	28,704	28,755	28,807	28,858	28,906
Lubbock	65,639	65,710	65,756	65,756	65,816	65,876	65,934	65,994	66,054	66,113	66,171
McLennan	42,203	42,265	42,287	42,287	42,320	42,352	42,381	42,411	42,442	42,471	42,501
Montgomery	87,720	87,847	87,917	87,917	87,977	88,037	88,094	88,149	88,203	88,265	88,316
Tarrant	361,915	362,366	362,366	362,366	362,786	363,188	363,581	363,966	364,386	364,780	365,155
Travis	119,609	119,762	119,762	119,762	119,875	119,988	120,101	120,213	120,322	120,431	120,537
Williamson	76,389	76,468	76,468	76,468	76,558	76,646	76,734	76,822	76,905	76,989	77,073

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:											
	10/28	10/29	10/30	10/31	11/2				11/4				11/6			
Bexar	321,013	321,186	321,186	321,186	321,667	(64,333)	[15,440]	{7,720}	322,131	(64,426)	[15,462]	{7,731}	322,594	(64,519)	[15,485]	{7,742}
Brazoria	59,673	59,705	59,756	59,756	59,852	(11,970)	[2,873]	{1,436}	59,947	(11,989)	[2,877]	{1,439}	60,043	(12,009)	[2,882]	{1,441}
Brazos	38,609	38,626	38,626	38,626	38,655	(7,731)	[1,855]	{928}	38,683	(7,737)	[1,857]	{928}	38,707	(7,741)	[1,858]	{929}
Collin	129,153	129,302	129,447	129,547	129,797	(25,959)	[6,230]	{3,115}	130,039	(26,008)	[6,242]	{3,121}	130,280	(26,056)	[6,253]	{3,127}
Dallas	404,096	404,367	404,637	404,637	405,343	(81,069)	[19,456]	{9,728}	406,033	(81,207)	[19,490]	{9,745}	406,725	(81,345)	[19,523]	{9,761}
Denton	107,539	107,757	107,757	107,757	108,122	(21,624)	[5,190]	{2,595}	108,472	(21,694)	[5,207]	{2,603}	108,821	(21,764)	[5,223]	{2,612}
El Paso	148,833	149,080	149,326	149,520	149,935	(29,987)	[7,197]	{3,598}	150,378	(30,076)	[7,218]	{3,609}	150,840	(30,168)	[7,240]	{3,620}
Ellis	33,568	33,594	33,623	33,623	33,733	(6,747)	[1,619]	{810}	33,839	(6,768)	[1,624]	{812}	33,940	(6,788)	[1,629]	{815}
Fort Bend	99,990	100,062	100,062	100,062	100,301	(20,060)	[4,814]	{2,407}	100,520	(20,104)	[4,825]	{2,412}	100,745	(20,149)	[4,836]	{2,418}
Galveston	64,101	64,134	64,200	64,200	64,290	(12,858)	[3,086]	{1,543}	64,377	(12,875)	[3,090]	{1,545}	64,460	(12,892)	[3,094]	{1,547}
Harris	575,129	575,587	575,946	575,974	576,738	(115,348)	[27,683]	{13,842}	577,434	(115,487)	[27,717]	{13,858}	578,151	(115,630)	[27,751]	{13,876}
Hidalgo	117,676	117,782	117,782	117,782	117,981	(23,596)	[5,663]	{2,832}	118,187	(23,637)	[5,673]	{2,836}	118,394	(23,679)	[5,683]	{2,841}
Johnson	28,452	28,488	28,547	28,547	28,652	(5,730)	[1,375]	{688}	28,755	(5,751)	[1,380]	{690}	28,858	(5,772)	[1,385]	{693}
Lubbock	65,639	65,710	65,756	65,756	65,876	(13,175)	[3,162]	{1,581}	65,994	(13,199)	[3,168]	{1,584}	66,113	(13,223)	[3,173]	{1,587}
McLennan	42,203	42,265	42,287	42,287	42,352	(8,470)	[2,033]	{1,016}	42,411	(8,482)	[2,036]	{1,018}	42,471	(8,494)	[2,039]	{1,019}
Montgomery	87,720	87,847	87,917	87,917	88,037	(17,607)	[4,226]	{2,113}	88,149	(17,630)	[4,231]	{2,116}	88,265	(17,653)	[4,237]	{2,118}
Tarrant	361,915	362,366	362,366	362,366	363,188	(72,638)	[17,433]	{8,717}	363,966	(72,793)	[17,470]	{8,735}	364,780	(72,956)	[17,509]	{8,755}
Travis	119,609	119,762	119,762	119,762	119,988	(23,998)	[5,759]	{2,880}	120,213	(24,043)	[5,770]	{2,885}	120,431	(24,086)	[5,781]	{2,890}
Williamson	76,389	76,468	76,468	76,468	76,646	(15,329)	[3,679]	{1,839}	76,822	(15,364)	[3,687]	{1,844}	76,989	(15,398)	[3,695]	{1,848}

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.