

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

Date: 2/16/21

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 2/16/21 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.

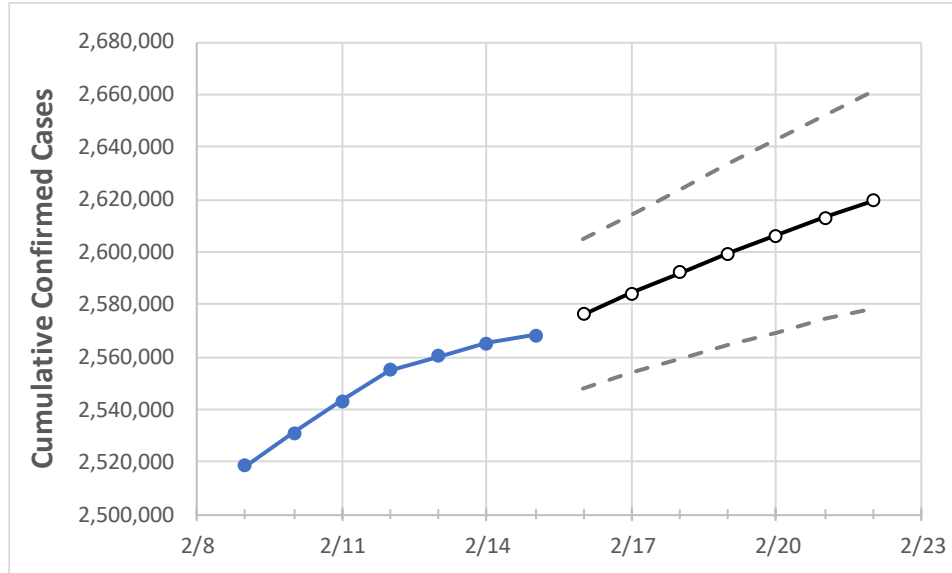
IEM's Modeling Lead

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:							
	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	
Texas	2,554,842	2,560,393	2,565,258	2,568,044	2,576,294	2,584,258	2,592,003	2,599,254	2,606,304	2,613,108	2,619,601	

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:							
	2/12	2/13	2/14	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	
Bexar	187,062	187,746	187,746	187,746	188,583	189,386	190,186	190,952	191,668	192,393	193,087	
Brazoria	30,889	31,036	31,145	31,130	31,286	31,438	31,587	31,736	31,880	32,017	32,155	
Brazos	20,054	20,091	20,160	20,160	20,237	20,311	20,383	20,454	20,521	20,587	20,651	
Collin	79,257	79,681	79,681	79,681	80,109	80,519	80,924	81,337	81,722	82,101	82,479	
Dallas	272,661	273,540	274,425	274,425	275,293	276,137	276,954	277,751	278,513	279,262	279,976	
Denton	59,849	60,167	60,167	60,167	60,658	61,148	61,653	62,141	62,640	63,143	63,628	
El Paso	118,715	119,148	119,476	119,774	120,148	120,514	120,876	121,228	121,583	121,934	122,280	
Ellis	19,981	20,066	20,066	20,066	20,144	20,221	20,297	20,369	20,440	20,506	20,573	
Fort Bend	55,272	55,272	55,272	55,272	55,709	56,149	56,593	57,036	57,478	57,926	58,389	
Galveston	32,846	33,067	33,142	33,142	33,287	33,430	33,568	33,699	33,830	33,957	34,077	
Harris	333,279	335,673	337,012	338,274	339,420	340,493	341,523	342,527	343,502	344,447	345,384	
Hidalgo	70,992	70,992	70,992	70,992	71,615	72,260	72,915	73,575	74,251	74,934	75,617	
Johnson	17,869	17,909	17,909	17,909	17,984	18,061	18,131	18,202	18,272	18,338	18,403	
Lubbock	47,673	47,715	47,760	47,788	47,833	47,876	47,918	47,957	47,994	48,030	48,064	
McLennan	24,168	24,214	24,245	24,245	24,309	24,371	24,429	24,487	24,545	24,601	24,656	
Montgomery	43,077	43,077	43,077	43,077	43,303	43,518	43,731	43,931	44,141	44,337	44,525	
Tarrant	234,246	234,707	235,167	235,964	236,849	237,690	238,573	239,363	240,161	240,995	241,729	
Travis	73,538	73,538	73,538	73,538	73,816	74,102	74,365	74,640	74,898	75,151	75,395	
Williamson	39,586	39,586	39,586	39,586	39,790	39,987	40,180	40,363	40,539	40,714	40,896	

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:											
	2/12	2/13	2/14	2/15	2/17			2/19			2/21					
Bexar	187,062	187,746	187,746	187,746	189,386	(37,877)	[9,091]	{4,545}	190,952	(38,190)	[9,166]	{4,583}	192,393	(38,479)	[9,235]	{4,617}
Brazoria	30,889	31,036	31,145	31,130	31,438	(6,288)	[1,509]	{755}	31,736	(6,347)	[1,523]	{762}	32,017	(6,403)	[1,537]	{768}
Brazos	20,054	20,091	20,160	20,160	20,311	(4,062)	[975]	{487}	20,454	(4,091)	[982]	{491}	20,587	(4,117)	[988]	{494}
Collin	79,257	79,681	79,681	79,681	80,519	(16,104)	[3,865]	{1,932}	81,337	(16,267)	[3,904]	{1,952}	82,101	(16,420)	[3,941]	{1,970}
Dallas	272,661	273,540	274,425	274,425	276,137	(55,227)	[13,255]	{6,627}	277,751	(55,550)	[13,332]	{6,666}	279,262	(55,852)	[13,405]	{6,702}
Denton	59,849	60,167	60,167	60,167	61,148	(12,230)	[2,935]	{1,468}	62,141	(12,428)	[2,983]	{1,491}	63,143	(12,629)	[3,031]	{1,515}
El Paso	118,715	119,148	119,476	119,774	120,514	(24,103)	[5,785]	{2,892}	121,228	(24,246)	[5,819]	{2,909}	121,934	(24,387)	[5,853]	{2,926}
Ellis	19,981	20,066	20,066	20,066	20,221	(4,044)	[971]	{485}	20,369	(4,074)	[978]	{489}	20,506	(4,101)	[984]	{492}
Fort Bend	55,272	55,272	55,272	55,272	56,149	(11,230)	[2,695]	{1,348}	57,036	(11,407)	[2,738]	{1,369}	57,926	(11,585)	[2,780]	{1,390}
Galveston	32,846	33,067	33,142	33,142	33,430	(6,686)	[1,605]	{802}	33,699	(6,740)	[1,618]	{809}	33,957	(6,791)	[1,630]	{815}
Harris	333,279	335,673	337,012	338,274	340,493	(68,099)	[16,344]	{8,172}	342,527	(68,505)	[16,441]	{8,221}	344,447	(68,889)	[16,533]	{8,267}
Hidalgo	70,992	70,992	70,992	70,992	72,260	(14,452)	[3,468]	{1,734}	73,575	(14,715)	[3,532]	{1,766}	74,934	(14,987)	[3,597]	{1,798}
Johnson	17,869	17,909	17,909	17,909	18,061	(3,612)	[867]	{433}	18,202	(3,640)	[874]	{437}	18,338	(3,668)	[880]	{440}
Lubbock	47,673	47,715	47,760	47,788	47,876	(9,575)	[2,298]	{1,149}	47,957	(9,591)	[2,302]	{1,151}	48,030	(9,606)	[2,305]	{1,153}
McLennan	24,168	24,214	24,245	24,245	24,371	(4,874)	[1,170]	{585}	24,487	(4,897)	[1,175]	{588}	24,601	(4,920)	[1,181]	{590}
Montgomery	43,077	43,077	43,077	43,077	43,518	(8,704)	[2,089]	{1,044}	43,931	(8,786)	[2,109]	{1,054}	44,337	(8,867)	[2,128]	{1,064}
Tarrant	234,246	234,707	235,167	235,964	237,690	(47,538)	[11,409]	{5,705}	239,363	(47,873)	[11,489]	{5,745}	240,995	(48,199)	[11,568]	{5,784}
Travis	73,538	73,538	73,538	73,538	74,102	(14,820)	[3,557]	{1,778}	74,640	(14,928)	[3,583]	{1,791}	75,151	(15,030)	[3,607]	{1,804}
Williamson	39,586	39,586	39,586	39,586	39,987	(7,997)	[1,919]	{960}	40,363	(8,073)	[1,937]	{969}	40,714	(8,143)	[1,954]	{977}

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.