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

Date: 7/30/21

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 7/30/21 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.

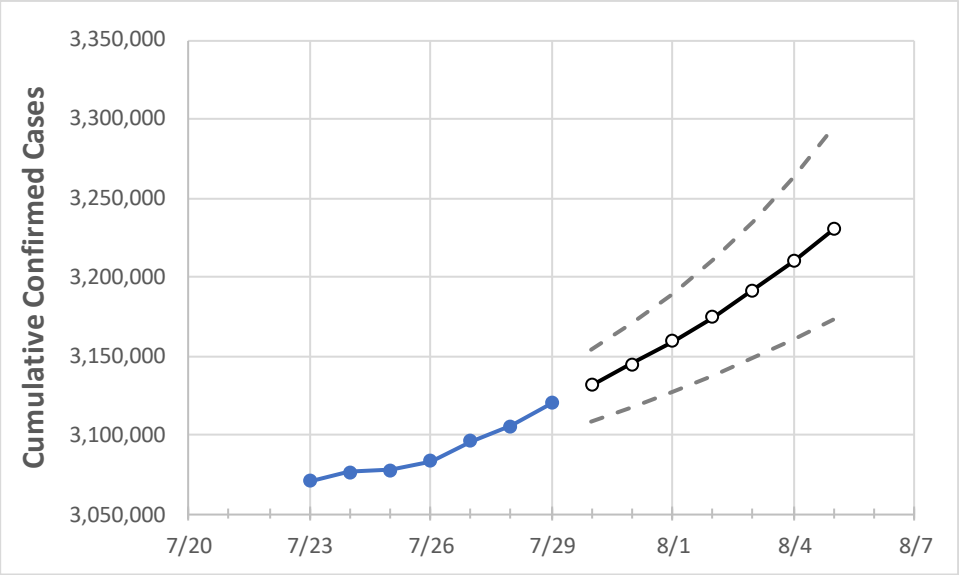
IEM's Modeling Lead

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:						
	7/26	7/27	7/28	7/29	7/30	7/31	8/1	8/2	8/3	8/4	8/5
Texas	3,083,368	3,095,920	3,105,208	3,119,924	3,131,749	3,144,807	3,159,179	3,174,724	3,191,538	3,209,920	3,230,409

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:						
	7/26	7/27	7/28	7/29	7/30	7/31	8/1	8/2	8/3	8/4	8/5
Bexar	236,096	236,682	237,866	239,050	239,934	240,871	241,880	242,945	244,073	245,297	246,593
Brazoria	40,161	40,197	40,547	40,694	40,844	40,996	41,164	41,339	41,532	41,740	41,957
Brazos	28,535	28,591	28,652	28,692	28,741	28,793	28,850	28,910	28,974	29,042	29,110
Collin	95,185	95,340	95,861	96,066	96,343	96,642	96,967	97,323	97,721	98,147	98,605
Dallas	312,919	314,372	315,361	316,111	316,984	317,920	318,965	320,111	321,334	322,675	324,122
Denton	78,924	79,128	79,359	79,563	79,744	79,943	80,145	80,369	80,609	80,859	81,124
El Paso	137,588	137,714	137,844	137,937	138,026	138,118	138,218	138,324	138,436	138,554	138,682
Ellis	23,447	23,487	23,511	23,613	23,667	23,725	23,789	23,858	23,935	24,021	24,114
Fort Bend	71,589	72,136	72,311	72,819	73,146	73,509	73,927	74,388	74,895	75,453	76,095
Galveston	43,097	43,241	43,528	43,864	44,129	44,423	44,745	45,094	45,469	45,891	46,342
Harris	413,404	414,098	414,434	418,911	420,810	422,886	425,261	427,876	430,830	434,054	437,783
Hidalgo	96,796	97,122	97,445	98,058	98,527	99,048	99,628	100,252	100,932	101,664	102,516
Johnson	20,493	20,534	20,551	20,639	20,681	20,728	20,780	20,837	20,896	20,960	21,029
Lubbock	50,339	50,400	50,483	50,605	50,717	50,843	50,981	51,128	51,294	51,478	51,679
McLennan	28,443	28,443	28,443	28,443	28,466	28,490	28,515	28,540	28,565	28,591	28,616
Montgomery	57,800	57,991	58,659	58,659	58,940	59,232	59,566	59,917	60,300	60,755	61,240
Tarrant	270,663	271,068	271,510	272,248	272,969	273,719	274,531	275,383	276,290	277,279	278,303
Travis	87,571	87,946	88,436	88,887	89,333	89,809	90,351	90,944	91,608	92,341	93,162
Williamson	49,613	49,778	50,219	50,219	50,436	50,664	50,899	51,146	51,411	51,697	51,987

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:											
	7/26	7/27	7/28	7/29	7/31				8/2				8/4			
Bexar	236,096	236,682	237,866	239,050	240,871	(48,174)	[11,562]	{5,781}	242,945	(48,589)	[11,661]	{5,831}	245,297	(49,059)	[11,774]	{5,887}
Brazoria	40,161	40,197	40,547	40,694	40,996	(8,199)	[1,968]	{984}	41,339	(8,268)	[1,984]	{992}	41,740	(8,348)	[2,004]	{1,002}
Brazos	28,535	28,591	28,652	28,692	28,793	(5,759)	[1,382]	{691}	28,910	(5,782)	[1,388]	{694}	29,042	(5,808)	[1,394]	{697}
Collin	95,185	95,340	95,861	96,066	96,642	(19,328)	[4,639]	{2,319}	97,323	(19,465)	[4,672]	{2,336}	98,147	(19,629)	[4,711]	{2,356}
Dallas	312,919	314,372	315,361	316,111	317,920	(63,584)	[15,260]	{7,630}	320,111	(64,022)	[15,365]	{7,683}	322,675	(64,535)	[15,488]	{7,744}
Denton	78,924	79,128	79,359	79,563	79,943	(15,989)	[3,837]	{1,919}	80,369	(16,074)	[3,858]	{1,929}	80,859	(16,172)	[3,881]	{1,941}
El Paso	137,588	137,714	137,844	137,937	138,118	(27,624)	[6,630]	{3,315}	138,324	(27,665)	[6,640]	{3,320}	138,554	(27,711)	[6,651]	{3,325}
Ellis	23,447	23,487	23,511	23,613	23,725	(4,745)	[1,139]	{569}	23,858	(4,772)	[1,145]	{573}	24,021	(4,804)	[1,153]	{577}
Fort Bend	71,589	72,136	72,311	72,819	73,509	(14,702)	[3,528]	{1,764}	74,388	(14,878)	[3,571]	{1,785}	75,453	(15,091)	[3,622]	{1,811}
Galveston	43,097	43,241	43,528	43,864	44,423	(8,885)	[2,132]	{1,066}	45,094	(9,019)	[2,165]	{1,082}	45,891	(9,178)	[2,203]	{1,101}
Harris	413,404	414,098	414,434	418,911	422,886	(84,577)	[20,299]	{10,149}	427,876	(85,575)	[20,538]	{10,269}	434,054	(86,811)	[20,835]	{10,417}
Hidalgo	96,796	97,122	97,445	98,058	99,048	(19,810)	[4,754]	{2,377}	100,252	(20,050)	[4,812]	{2,406}	101,664	(20,333)	[4,880]	{2,440}
Johnson	20,493	20,534	20,551	20,639	20,728	(4,146)	[995]	{497}	20,837	(4,167)	[1,000]	{500}	20,960	(4,192)	[1,006]	{503}
Lubbock	50,339	50,400	50,483	50,605	50,843	(10,169)	[2,440]	{1,220}	51,128	(10,226)	[2,454]	{1,227}	51,478	(10,296)	[2,471]	{1,235}
McLennan	28,443	28,443	28,443	28,443	28,490	(5,698)	[1,368]	{684}	28,540	(5,708)	[1,370]	{685}	28,591	(5,718)	[1,372]	{686}
Montgomery	57,800	57,991	58,659	58,659	59,232	(11,846)	[2,843]	{1,422}	59,917	(11,983)	[2,876]	{1,438}	60,755	(12,151)	[2,916]	{1,458}
Tarrant	270,663	271,068	271,510	272,248	273,719	(54,744)	[13,139]	{6,569}	275,383	(55,077)	[13,218]	{6,609}	277,279	(55,456)	[13,309]	{6,655}
Travis	87,571	87,946	88,436	88,887	89,809	(17,962)	[4,311]	{2,155}	90,944	(18,189)	[4,365]	{2,183}	92,341	(18,468)	[4,432]	{2,216}
Williamson	49,613	49,778	50,219	50,219	50,664	(10,133)	[2,432]	{1,216}	51,146	(10,229)	[2,455]	{1,228}	51,697	(10,339)	[2,481]	{1,241}

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.