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

Date: 9/13/21

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 9/13/21 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.

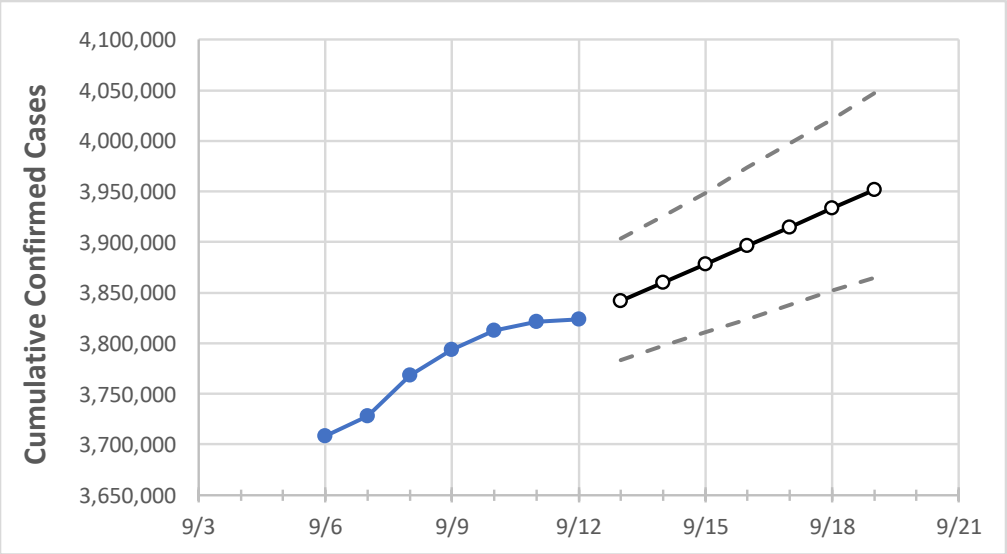
IEM's Modeling Lead

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:						
	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16	9/17	9/18	9/19
Texas	3,793,204	3,812,711	3,821,518	3,823,937	3,841,581	3,860,162	3,878,542	3,896,214	3,914,318	3,933,197	3,951,822

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:						
	9/9	9/10	9/11	9/12	9/13	9/14	9/15	9/16	9/17	9/18	9/19
Bexar	295,953	296,573	296,573	296,573	297,736	298,874	300,016	301,123	302,252	303,406	304,511
Brazoria	53,901	54,325	54,325	54,325	54,767	55,197	55,632	56,082	56,527	56,993	57,453
Brazos	32,341	32,524	32,524	32,524	32,692	32,854	33,032	33,208	33,401	33,589	33,784
Collin	115,857	116,337	116,794	117,227	117,894	118,572	119,297	119,955	120,669	121,400	122,133
Dallas	364,895	366,278	366,278	366,278	367,801	369,440	371,053	372,826	374,435	376,172	377,915
Denton	92,764	93,227	93,227	93,227	93,653	94,071	94,495	94,926	95,382	95,841	96,285
El Paso	142,897	143,016	143,112	143,199	143,295	143,390	143,484	143,579	143,672	143,765	143,857
Ellis	28,895	29,041	29,160	29,160	29,369	29,591	29,807	30,029	30,256	30,480	30,721
Fort Bend	88,522	88,936	88,936	88,936	89,476	90,021	90,567	91,136	91,695	92,343	92,917
Galveston	57,460	57,670	57,932	58,267	58,575	58,886	59,194	59,492	59,801	60,113	60,409
Harris	521,211	522,156	525,128	526,158	528,407	530,747	532,964	535,271	537,527	539,788	542,184
Hidalgo	110,200	110,502	110,502	110,502	110,717	110,946	111,145	111,361	111,576	111,796	112,014
Johnson	24,167	24,348	24,463	24,463	24,599	24,746	24,887	25,034	25,185	25,341	25,494
Lubbock	59,753	60,031	60,296	60,296	60,687	61,071	61,471	61,876	62,292	62,724	63,160
McLennan	36,962	37,205	37,492	37,492	37,807	38,138	38,463	38,804	39,138	39,495	39,862
Montgomery	78,992	79,450	79,450	79,450	80,094	80,752	81,388	82,043	82,719	83,393	84,071
Tarrant	317,324	319,204	319,204	319,204	320,833	322,506	324,239	325,898	327,727	329,494	331,419
Travis	108,932	109,645	109,645	109,645	110,245	110,878	111,496	112,114	112,745	113,419	114,091
Williamson	66,679	67,141	67,141	67,141	67,654	68,165	68,689	69,218	69,755	70,287	70,841

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:			
	9/9	9/10	9/11	9/12	9/14	9/16	9/18	
Bexar	295,953	296,573	296,573	296,573	298,874 (59,775) [14,346] {7,173}	301,123 (60,225) [14,454] {7,227}	303,406 (60,681) [14,563] {7,282}	
Brazoria	53,901	54,325	54,325	54,325	55,197 (11,039) [2,649] {1,325}	56,082 (11,216) [2,692] {1,346}	56,993 (11,399) [2,736] {1,368}	
Brazos	32,341	32,524	32,524	32,524	32,854 (6,571) [1,577] {788}	33,208 (6,642) [1,594] {797}	33,589 (6,718) [1,612] {806}	
Collin	115,857	116,337	116,794	117,227	118,572 (23,714) [5,691] {2,846}	119,955 (23,991) [5,758] {2,879}	121,400 (24,280) [5,827] {2,914}	
Dallas	364,895	366,278	366,278	366,278	369,440 (73,888) [17,733] {8,867}	372,826 (74,565) [17,896] {8,948}	376,172 (75,234) [18,056] {9,028}	
Denton	92,764	93,227	93,227	93,227	94,071 (18,814) [4,515] {2,258}	94,926 (18,985) [4,556] {2,278}	95,841 (19,168) [4,600] {2,300}	
El Paso	142,897	143,016	143,112	143,199	143,390 (28,678) [6,883] {3,441}	143,579 (28,716) [6,892] {3,446}	143,765 (28,753) [6,901] {3,450}	
Ellis	28,895	29,041	29,160	29,160	29,591 (5,918) [1,420] {710}	30,029 (6,006) [1,441] {721}	30,480 (6,096) [1,463] {732}	
Fort Bend	88,522	88,936	88,936	88,936	90,021 (18,004) [4,321] {2,161}	91,136 (18,227) [4,375] {2,187}	92,343 (18,469) [4,432] {2,216}	
Galveston	57,460	57,670	57,932	58,267	58,886 (11,777) [2,827] {1,413}	59,492 (11,898) [2,856] {1,428}	60,113 (12,023) [2,885] {1,443}	
Harris	521,211	522,156	525,128	526,158	530,747 (106,149) [25,476] {12,738}	535,271 (107,054) [25,693] {12,846}	539,788 (107,958) [25,910] {12,955}	
Hidalgo	110,200	110,502	110,502	110,502	110,946 (22,189) [5,325] {2,663}	111,361 (22,272) [5,345] {2,673}	111,796 (22,359) [5,366] {2,683}	
Johnson	24,167	24,348	24,463	24,463	24,746 (4,949) [1,188] {594}	25,034 (5,007) [1,202] {601}	25,341 (5,068) [1,216] {608}	
Lubbock	59,753	60,031	60,296	60,296	61,071 (12,214) [2,931] {1,466}	61,876 (12,375) [2,970] {1,485}	62,724 (12,545) [3,011] {1,505}	
McLennan	36,962	37,205	37,492	37,492	38,138 (7,628) [1,831] {915}	38,804 (7,761) [1,863] {931}	39,495 (7,899) [1,896] {948}	
Montgomery	78,992	79,450	79,450	79,450	80,752 (16,150) [3,876] {1,938}	82,043 (16,409) [3,938] {1,969}	83,393 (16,679) [4,003] {2,001}	
Tarrant	317,324	319,204	319,204	319,204	322,506 (64,501) [15,480] {7,740}	325,898 (65,180) [15,643] {7,822}	329,494 (65,899) [15,816] {7,908}	
Travis	108,932	109,645	109,645	109,645	110,878 (22,176) [5,322] {2,661}	112,114 (22,423) [5,381] {2,691}	113,419 (22,684) [5,444] {2,722}	
Williamson	66,679	67,141	67,141	67,141	68,165 (13,633) [3,272] {1,636}	69,218 (13,844) [3,322] {1,661}	70,287 (14,057) [3,374] {1,687}	

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.