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

Date: 2/19/21

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 2/19/21 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.

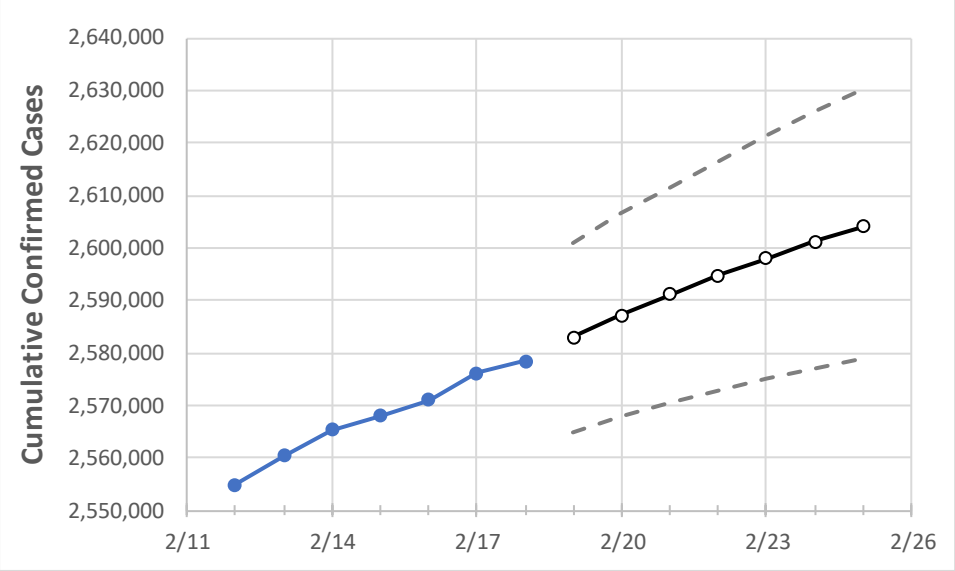
IEM's Modeling Lead

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:						
	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23	2/24	2/25
Texas	2,568,044	2,570,958	2,576,098	2,578,396	2,582,943	2,587,239	2,591,106	2,594,679	2,597,994	2,601,148	2,603,984

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:						
	2/15	2/16	2/17	2/18	2/19	2/20	2/21	2/22	2/23	2/24	2/25
Bexar	187,746	187,746	187,746	187,746	188,358	188,941	189,489	190,039	190,540	191,030	191,504
Brazoria	31,130	31,225	31,266	31,266	31,363	31,460	31,551	31,639	31,725	31,804	31,880
Brazos	20,160	20,160	20,160	20,160	20,216	20,269	20,321	20,370	20,416	20,459	20,501
Collin	80,188	80,441	80,777	80,947	81,235	81,513	81,781	82,034	82,287	82,519	82,748
Dallas	274,913	275,400	275,783	276,049	276,629	277,177	277,694	278,178	278,653	279,096	279,522
Denton	60,167	60,167	60,167	60,167	60,680	61,214	61,747	62,272	62,797	63,340	63,875
El Paso	119,774	119,997	120,205	120,556	120,879	121,199	121,501	121,806	122,098	122,396	122,680
Ellis	20,199	20,265	20,331	20,331	20,390	20,447	20,499	20,549	20,600	20,646	20,689
Fort Bend	55,272	55,272	55,272	55,272	55,680	56,114	56,543	56,942	57,362	57,777	58,235
Galveston	33,142	33,142	33,142	33,142	33,256	33,366	33,475	33,580	33,677	33,780	33,872
Harris	338,274	338,284	339,366	339,444	340,195	340,918	341,627	342,308	342,942	343,574	344,168
Hidalgo	71,442	71,592	71,744	72,213	72,490	72,760	73,014	73,266	73,500	73,731	73,944
Johnson	18,033	18,095	18,157	18,149	18,203	18,256	18,307	18,353	18,399	18,443	18,485
Lubbock	47,788	47,802	47,851	47,883	47,914	47,943	47,970	47,996	48,022	48,046	48,068
McLennan	24,257	24,268	24,268	24,268	24,319	24,368	24,416	24,464	24,511	24,555	24,600
Montgomery	43,077	43,077	43,077	43,077	43,258	43,428	43,595	43,759	43,911	44,059	44,205
Tarrant	235,964	236,213	236,461	236,911	237,381	237,861	238,304	238,701	239,101	239,488	239,826
Travis	73,538	73,538	73,538	73,538	73,737	73,924	74,107	74,282	74,441	74,596	74,747
Williamson	39,586	39,586	39,586	39,586	39,738	39,902	40,051	40,193	40,325	40,459	40,585

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:		
	2/15	2/16	2/17	2/18	2/20	2/22	2/24
Bexar	187,746	187,746	187,746	187,746	188,941 (37,788) [9,069] {4,535}	190,039 (38,008) [9,122] {4,561}	191,030 (38,206) [9,169] {4,585}
Brazoria	31,130	31,225	31,266	31,266	31,460 (6,292) [1,510] {755}	31,639 (6,328) [1,519] {759}	31,804 (6,361) [1,527] {763}
Brazos	20,160	20,160	20,160	20,160	20,269 (4,054) [973] {486}	20,370 (4,074) [978] {489}	20,459 (4,092) [982] {491}
Collin	80,188	80,441	80,777	80,947	81,513 (16,303) [3,913] {1,956}	82,034 (16,407) [3,938] {1,969}	82,519 (16,504) [3,961] {1,980}
Dallas	274,913	275,400	275,783	276,049	277,177 (55,435) [13,305] {6,652}	278,178 (55,636) [13,353] {6,676}	279,096 (55,819) [13,397] {6,698}
Denton	60,167	60,167	60,167	60,167	61,214 (12,243) [2,938] {1,469}	62,272 (12,454) [2,989] {1,495}	63,340 (12,668) [3,040] {1,520}
El Paso	119,774	119,997	120,205	120,556	121,199 (24,240) [5,818] {2,909}	121,806 (24,361) [5,847] {2,923}	122,396 (24,479) [5,875] {2,937}
Ellis	20,199	20,265	20,331	20,331	20,447 (4,089) [981] {491}	20,549 (4,110) [986] {493}	20,646 (4,129) [991] {496}
Fort Bend	55,272	55,272	55,272	55,272	56,114 (11,223) [2,693] {1,347}	56,942 (11,388) [2,733] {1,367}	57,777 (11,555) [2,773] {1,387}
Galveston	33,142	33,142	33,142	33,142	33,366 (6,673) [1,602] {801}	33,580 (6,716) [1,612] {806}	33,780 (6,756) [1,621] {811}
Harris	338,274	338,284	339,366	339,444	340,918 (68,184) [16,364] {8,182}	342,308 (68,462) [16,431] {8,215}	343,574 (68,715) [16,492] {8,246}
Hidalgo	71,442	71,592	71,744	72,213	72,760 (14,552) [3,492] {1,746}	73,266 (14,653) [3,517] {1,758}	73,731 (14,746) [3,539] {1,770}
Johnson	18,033	18,095	18,157	18,149	18,256 (3,651) [876] {438}	18,353 (3,671) [881] {440}	18,443 (3,689) [885] {443}
Lubbock	47,788	47,802	47,851	47,883	47,943 (9,589) [2,301] {1,151}	47,996 (9,599) [2,304] {1,152}	48,046 (9,609) [2,306] {1,153}
McLennan	24,257	24,268	24,268	24,268	24,368 (4,874) [1,170] {585}	24,464 (4,893) [1,174] {587}	24,555 (4,911) [1,179] {589}
Montgomery	43,077	43,077	43,077	43,077	43,428 (8,686) [2,085] {1,042}	43,759 (8,752) [2,100] {1,050}	44,059 (8,812) [2,115] {1,057}
Tarrant	235,964	236,213	236,461	236,911	237,861 (47,572) [11,417] {5,709}	238,701 (47,740) [11,458] {5,729}	239,488 (47,898) [11,495] {5,748}
Travis	73,538	73,538	73,538	73,538	73,924 (14,785) [3,548] {1,774}	74,282 (14,856) [3,566] {1,783}	74,596 (14,919) [3,581] {1,790}
Williamson	39,586	39,586	39,586	39,586	39,902 (7,980) [1,915] {958}	40,193 (8,039) [1,929] {965}	40,459 (8,092) [1,942] {971}

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.