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

Date: 4/2/21

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 4/2/21 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.

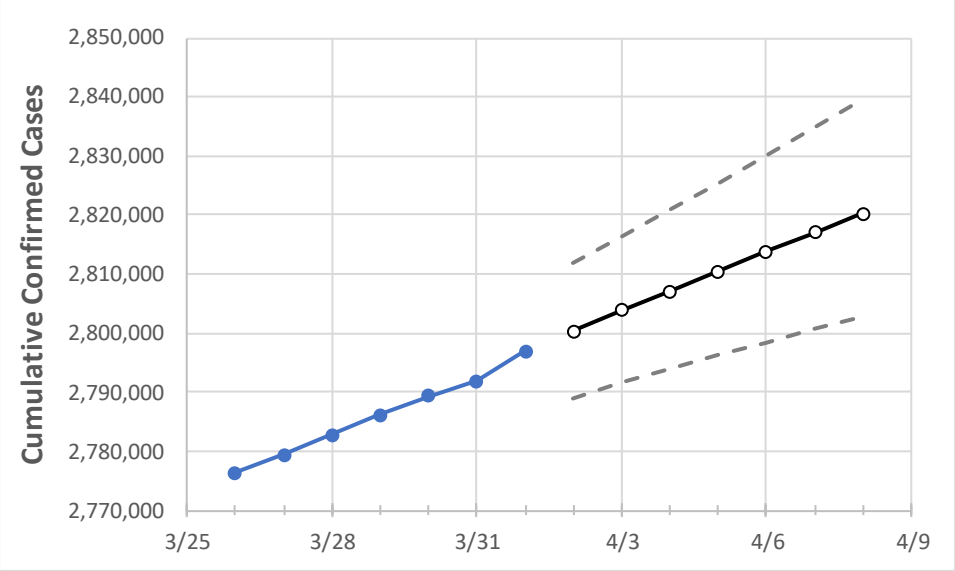
IEM's Modeling Lead

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:						
	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8
Texas	2,786,219	2,789,428	2,791,910	2,797,010	2,800,403	2,803,819	2,807,128	2,810,485	2,813,832	2,817,083	2,820,329

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:						
	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5	4/6	4/7	4/8
Bexar	205,258	205,406	205,528	205,777	206,086	206,369	206,676	206,952	207,247	207,562	207,874
Brazoria	35,387	35,462	35,521	35,579	35,642	35,703	35,765	35,826	35,886	35,943	36,001
Brazos	25,020	25,057	25,123	25,189	25,248	25,311	25,370	25,431	25,492	25,551	25,613
Collin	86,358	86,459	86,623	86,787	86,889	86,994	87,101	87,206	87,310	87,413	87,517
Dallas	291,003	290,898	291,262	291,589	291,936	292,291	292,646	292,997	293,352	293,697	294,061
Denton	71,665	71,752	71,881	71,976	72,027	72,077	72,125	72,169	72,208	72,249	72,285
El Paso	129,115	129,209	129,495	129,723	129,860	129,997	130,134	130,272	130,408	130,541	130,670
Ellis	22,077	22,094	22,133	22,172	22,187	22,201	22,215	22,230	22,244	22,257	22,271
Fort Bend	62,938	63,240	63,354	63,440	63,546	63,639	63,734	63,830	63,923	64,018	64,110
Galveston	37,003	37,059	37,125	37,190	37,249	37,307	37,365	37,421	37,476	37,532	37,588
Harris	375,809	376,577	377,152	377,720	378,354	378,968	379,595	380,218	380,848	381,449	382,045
Hidalgo	84,611	84,755	84,969	85,141	85,249	85,351	85,449	85,546	85,641	85,734	85,823
Johnson	19,253	19,270	19,302	19,334	19,357	19,379	19,401	19,424	19,446	19,468	19,491
Lubbock	48,556	48,566	48,579	48,591	48,602	48,612	48,623	48,635	48,645	48,656	48,666
McLennan	26,046	26,074	26,098	26,122	26,150	26,177	26,204	26,230	26,256	26,281	26,306
Montgomery	49,238	49,368	49,477	49,605	49,727	49,846	49,962	50,078	50,193	50,313	50,432
Tarrant	250,493	250,646	250,869	251,106	251,268	251,429	251,586	251,734	251,883	252,023	252,162
Travis	78,994	79,085	79,217	79,324	79,426	79,527	79,627	79,727	79,828	79,929	80,033
Williamson	43,056	43,106	43,184	43,275	43,351	43,428	43,506	43,582	43,659	43,737	43,816

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:		
	3/29	3/30	3/31	4/1	4/3	4/5	4/7
Bexar	205,258	205,406	205,528	205,777	206,369 (41,274) [9,906] {4,953}	206,952 (41,390) [9,934] {4,967}	207,562 (41,512) [9,963] {4,981}
Brazoria	35,387	35,462	35,521	35,579	35,703 (7,141) [1,714] {857}	35,826 (7,165) [1,720] {860}	35,943 (7,189) [1,725] {863}
Brazos	25,020	25,057	25,123	25,189	25,311 (5,062) [1,215] {607}	25,431 (5,086) [1,221] {610}	25,551 (5,110) [1,226] {613}
Collin	86,358	86,459	86,623	86,787	86,994 (17,399) [4,176] {2,088}	87,206 (17,441) [4,186] {2,093}	87,413 (17,483) [4,196] {2,098}
Dallas	291,003	290,898	291,262	291,589	292,291 (58,458) [14,030] {7,015}	292,997 (58,599) [14,064] {7,032}	293,697 (58,739) [14,097] {7,049}
Denton	71,665	71,752	71,881	71,976	72,077 (14,415) [3,460] {1,730}	72,169 (14,434) [3,464] {1,732}	72,249 (14,450) [3,468] {1,734}
El Paso	129,115	129,209	129,495	129,723	129,997 (25,999) [6,240] {3,120}	130,272 (26,054) [6,253] {3,127}	130,541 (26,108) [6,266] {3,133}
Ellis	22,077	22,094	22,133	22,172	22,201 (4,440) [1,066] {533}	22,230 (4,446) [1,067] {534}	22,257 (4,451) [1,068] {534}
Fort Bend	62,938	63,240	63,354	63,440	63,639 (12,728) [3,055] {1,527}	63,830 (12,766) [3,064] {1,532}	64,018 (12,804) [3,073] {1,536}
Galveston	37,003	37,059	37,125	37,190	37,307 (7,461) [1,791] {895}	37,421 (7,484) [1,796] {898}	37,532 (7,506) [1,802] {901}
Harris	375,809	376,577	377,152	377,720	378,968 (75,794) [18,190] {9,095}	380,218 (76,044) [18,250] {9,125}	381,449 (76,290) [18,310] {9,155}
Hidalgo	84,611	84,755	84,969	85,141	85,351 (17,070) [4,097] {2,048}	85,546 (17,109) [4,106] {2,053}	85,734 (17,147) [4,115] {2,058}
Johnson	19,253	19,270	19,302	19,334	19,379 (3,876) [930] {465}	19,424 (3,885) [932] {466}	19,468 (3,894) [934] {467}
Lubbock	48,556	48,566	48,579	48,591	48,612 (9,722) [2,333] {1,167}	48,635 (9,727) [2,334] {1,167}	48,656 (9,731) [2,335] {1,168}
McLennan	26,046	26,074	26,098	26,122	26,177 (5,235) [1,257] {628}	26,230 (5,246) [1,259] {630}	26,281 (5,256) [1,262] {631}
Montgomery	49,238	49,368	49,477	49,605	49,846 (9,969) [2,393] {1,196}	50,078 (10,016) [2,404] {1,202}	50,313 (10,063) [2,415] {1,208}
Tarrant	250,493	250,646	250,869	251,106	251,429 (50,286) [12,069] {6,034}	251,734 (50,347) [12,083] {6,042}	252,023 (50,405) [12,097] {6,049}
Travis	78,994	79,085	79,217	79,324	79,527 (15,905) [3,817] {1,909}	79,727 (15,945) [3,827] {1,913}	79,929 (15,986) [3,837] {1,918}
Williamson	43,056	43,106	43,184	43,275	43,428 (8,686) [2,085] {1,042}	43,582 (8,716) [2,092] {1,046}	43,737 (8,747) [2,099] {1,050}

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.