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

Date: 8/11/20

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 20%, and are often within 10%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 8/11/20 12 p.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.

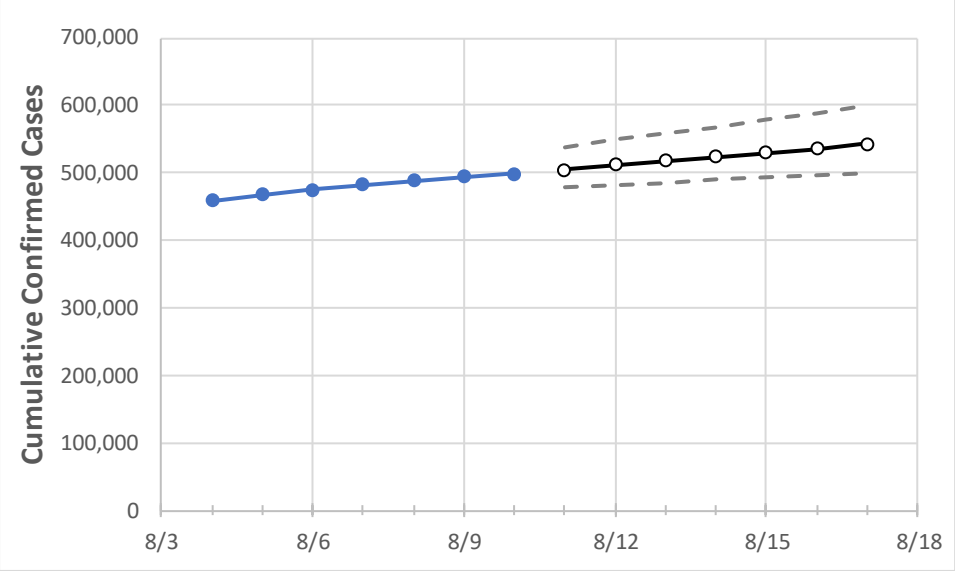
IEM's Modeling Lead

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:						
	8/7	8/8	8/9	8/10	8/11	8/12	8/13	8/14	8/15	8/16	8/17
Texas	482,065	489,098	494,107	498,571	504,972	511,334	517,657	523,940	530,185	536,390	542,557

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 20%, and are often within 10%, of actual confirmed cases.

Texas Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	8/7	8/8	8/9	8/10	8/11	8/12	8/13	8/14	8/15	8/16	8/17
Bexar	42,299	42,531	42,783	42,959	43,146	43,324	43,495	43,657	43,813	43,961	44,102
Brazoria	7,090	7,215	7,357	7,481	7,596	7,711	7,827	7,944	8,062	8,181	8,300
Brazos	3,997	4,024	4,040	4,055	4,071	4,086	4,101	4,116	4,130	4,144	4,157
Collin	7,074	7,268	7,439	7,654	7,755	7,858	7,964	8,072	8,183	8,297	8,413
Dallas	52,869	53,291	53,831	54,674	55,092	55,501	55,901	56,291	56,672	57,044	57,408
Denton	7,374	7,519	7,586	7,644	7,733	7,822	7,910	7,998	8,085	8,171	8,257
El Paso	15,908	16,040	16,308	16,396	16,565	16,733	16,899	17,064	17,227	17,389	17,549
Ellis	2,808	2,855	2,855	2,855	2,893	2,930	2,969	3,007	3,046	3,086	3,125
Fort Bend	8,878	9,151	9,533	9,533	9,758	9,997	10,252	10,523	10,811	11,117	11,443
Galveston	9,230	9,291	9,376	9,376	9,439	9,500	9,559	9,617	9,672	9,726	9,778
Harris	81,919	83,183	84,600	85,757	87,158	88,567	89,985	91,411	92,846	94,289	95,741
Hidalgo	19,103	19,534	19,638	19,741	19,961	20,179	20,396	20,611	20,824	21,035	21,244
Johnson	1,810	1,861	1,861	1,861	1,910	1,961	2,014	2,068	2,124	2,181	2,241
Lubbock	5,959	6,018	6,039	6,059	6,105	6,150	6,194	6,237	6,279	6,321	6,361
McLennan	4,846	4,889	4,946	4,970	5,019	5,067	5,114	5,162	5,209	5,255	5,301
Montgomery	6,510	6,577	6,577	6,577	6,626	6,674	6,721	6,767	6,812	6,855	6,898
Tarrant	30,650	30,922	31,687	32,177	32,525	32,871	33,215	33,556	33,896	34,233	34,569
Travis	22,256	22,480	22,602	22,724	22,889	23,051	23,210	23,365	23,518	23,668	23,814
Williamson	6,058	6,245	6,245	6,245	6,301	6,356	6,411	6,465	6,519	6,572	6,625

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:		
	8/7	8/8	8/9	8/10	8/12	8/14	8/16
Bexar	42,299	42,531	42,783	42,959	43,324 (8,665) [2,080] {1,040}	43,657 (8,731) [2,096] {1,048}	43,961 (8,792) [2,110] {1,055}
Brazoria	7,090	7,215	7,357	7,481	7,711 (1,542) [370] {185}	7,944 (1,589) [381] {191}	8,181 (1,636) [393] {196}
Brazos	3,997	4,024	4,040	4,055	4,086 (817) [196] {98}	4,116 (823) [198] {99}	4,144 (829) [199] {99}
Collin	7,074	7,268	7,439	7,654	7,858 (1,572) [377] {189}	8,072 (1,614) [387] {194}	8,297 (1,659) [398] {199}
Dallas	52,869	53,291	53,831	54,674	55,501 (11,100) [2,664] {1,332}	56,291 (11,258) [2,702] {1,351}	57,044 (11,409) [2,738] {1,369}
Denton	7,374	7,519	7,586	7,644	7,822 (1,564) [375] {188}	7,998 (1,600) [384] {192}	8,171 (1,634) [392] {196}
El Paso	15,908	16,040	16,308	16,396	16,733 (3,347) [803] {402}	17,064 (3,413) [819] {410}	17,389 (3,478) [835] {417}
Ellis	2,808	2,855	2,855	2,855	2,930 (586) [141] {70}	3,007 (601) [144] {72}	3,086 (617) [148] {74}
Fort Bend	8,878	9,151	9,533	9,533	9,997 (1,999) [480] {240}	10,523 (2,105) [505] {253}	11,117 (2,223) [534] {267}
Galveston	9,230	9,291	9,376	9,376	9,500 (1,900) [456] {228}	9,617 (1,923) [462] {231}	9,726 (1,945) [467] {233}
Harris	81,919	83,183	84,600	85,757	88,567 (17,713) [4,251] {2,126}	91,411 (18,282) [4,388] {2,194}	94,289 (18,858) [4,526] {2,263}
Hidalgo	19,103	19,534	19,638	19,741	20,179 (4,036) [969] {484}	20,611 (4,122) [989] {495}	21,035 (4,207) [1,010] {505}
Johnson	1,810	1,861	1,861	1,861	1,961 (392) [94] {47}	2,068 (414) [99] {50}	2,181 (436) [105] {52}
Lubbock	5,959	6,018	6,039	6,059	6,150 (1,230) [295] {148}	6,237 (1,247) [299] {150}	6,321 (1,264) [303] {152}
McLennan	4,846	4,889	4,946	4,970	5,067 (1,013) [243] {122}	5,162 (1,032) [248] {124}	5,255 (1,051) [252] {126}
Montgomery	6,510	6,577	6,577	6,577	6,674 (1,335) [320] {160}	6,767 (1,353) [325] {162}	6,855 (1,371) [329] {165}
Tarrant	30,650	30,922	31,687	32,177	32,871 (6,574) [1,578] {789}	33,556 (6,711) [1,611] {805}	34,233 (6,847) [1,643] {822}
Travis	22,256	22,480	22,602	22,724	23,051 (4,610) [1,106] {553}	23,365 (4,673) [1,122] {561}	23,668 (4,734) [1,136] {568}
Williamson	6,058	6,245	6,245	6,245	6,356 (1,271) [305] {153}	6,465 (1,293) [310] {155}	6,572 (1,314) [315] {158}

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.