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

Date: 6/8/21

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 6/8/21 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.

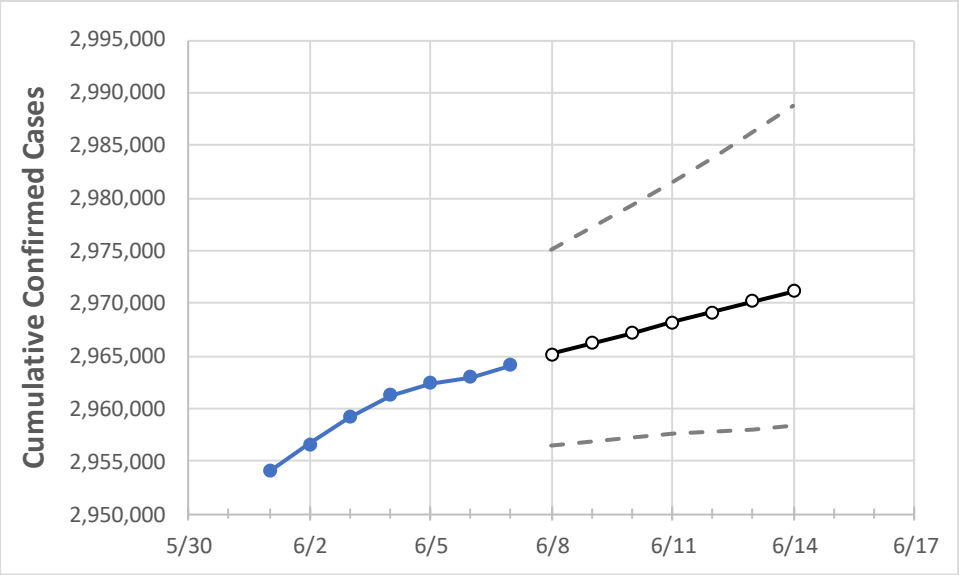
IEM's Modeling Lead

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:						
	6/4	6/5	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13	6/14
Texas	2,961,257	2,962,395	2,962,934	2,964,109	2,965,155	2,966,222	2,967,191	2,968,204	2,969,164	2,970,155	2,971,125

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:						
	6/4	6/5	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13	6/14
Bexar	224,185	224,185	224,185	224,185	224,337	224,480	224,627	224,769	224,913	225,064	225,220
Brazoria	38,214	38,231	38,231	38,231	38,250	38,269	38,289	38,309	38,329	38,347	38,367
Brazos	27,663	27,675	27,687	27,699	27,714	27,729	27,743	27,758	27,772	27,788	27,803
Collin	91,521	91,521	91,521	91,521	91,545	91,567	91,589	91,611	91,631	91,653	91,672
Dallas	303,756	303,854	303,854	303,854	303,934	304,016	304,089	304,162	304,234	304,308	304,382
Denton	76,279	76,301	76,322	76,344	76,370	76,397	76,421	76,446	76,469	76,491	76,515
El Paso	136,196	136,208	136,233	136,251	136,267	136,284	136,299	136,314	136,327	136,340	136,354
Ellis	23,088	23,094	23,094	23,094	23,101	23,109	23,116	23,122	23,129	23,136	23,143
Fort Bend	68,993	69,005	69,017	69,029	69,056	69,082	69,105	69,130	69,155	69,178	69,201
Galveston	40,494	40,517	40,551	40,551	40,571	40,590	40,609	40,627	40,644	40,660	40,676
Harris	401,345	401,469	401,812	402,148	402,392	402,634	402,881	403,125	403,366	403,596	403,838
Hidalgo	91,718	91,747	91,775	91,804	91,846	91,888	91,928	91,965	92,000	92,034	92,068
Johnson	19,991	19,998	19,997	19,997	20,004	20,011	20,018	20,025	20,032	20,038	20,045
Lubbock	49,364	49,371	49,371	49,371	49,377	49,383	49,389	49,394	49,399	49,405	49,410
McLennan	27,581	27,592	27,592	27,592	27,605	27,618	27,631	27,643	27,655	27,667	27,679
Montgomery	54,643	54,624	54,624	54,624	54,651	54,679	54,705	54,729	54,754	54,777	54,798
Tarrant	261,124	261,163	261,201	261,365	261,428	261,490	261,550	261,608	261,664	261,720	261,772
Travis	83,910	83,927	83,945	83,962	83,984	84,005	84,024	84,045	84,064	84,084	84,103
Williamson	47,083	47,124	47,165	47,206	47,260	47,314	47,369	47,426	47,484	47,543	47,604

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:		
	6/4	6/5	6/6	6/7	6/9	6/11	6/13
Bexar	224,185	224,185	224,185	224,185	224,480 (44,896) [10,775] {5,388}	224,769 (44,954) [10,789] {5,394}	225,064 (45,013) [10,803] {5,402}
Brazoria	38,214	38,231	38,231	38,231	38,269 (7,654) [1,837] {918}	38,309 (7,662) [1,839] {919}	38,347 (7,669) [1,841] {920}
Brazos	27,663	27,675	27,687	27,699	27,729 (5,546) [1,331] {665}	27,758 (5,552) [1,332] {666}	27,788 (5,558) [1,334] {667}
Collin	91,521	91,521	91,521	91,521	91,567 (18,313) [4,395] {2,198}	91,611 (18,322) [4,397] {2,199}	91,653 (18,331) [4,399] {2,200}
Dallas	303,756	303,854	303,854	303,854	304,016 (60,803) [14,593] {7,296}	304,162 (60,832) [14,600] {7,300}	304,308 (60,862) [14,607] {7,303}
Denton	76,279	76,301	76,322	76,344	76,397 (15,279) [3,667] {1,834}	76,446 (15,289) [3,669] {1,835}	76,491 (15,298) [3,672] {1,836}
El Paso	136,196	136,208	136,233	136,251	136,284 (27,257) [6,542] {3,271}	136,314 (27,263) [6,543] {3,272}	136,340 (27,268) [6,544] {3,272}
Ellis	23,088	23,094	23,094	23,094	23,109 (4,622) [1,109] {555}	23,122 (4,624) [1,110] {555}	23,136 (4,627) [1,111] {555}
Fort Bend	68,993	69,005	69,017	69,029	69,082 (13,816) [3,316] {1,658}	69,130 (13,826) [3,318] {1,659}	69,178 (13,836) [3,321] {1,660}
Galveston	40,494	40,517	40,551	40,551	40,590 (8,118) [1,948] {974}	40,627 (8,125) [1,950] {975}	40,660 (8,132) [1,952] {976}
Harris	401,345	401,469	401,812	402,148	402,634 (80,527) [19,326] {9,663}	403,125 (80,625) [19,350] {9,675}	403,596 (80,719) [19,373] {9,686}
Hidalgo	91,718	91,747	91,775	91,804	91,888 (18,378) [4,411] {2,205}	91,965 (18,393) [4,414] {2,207}	92,034 (18,407) [4,418] {2,209}
Johnson	19,991	19,998	19,997	19,997	20,011 (4,002) [961] {480}	20,025 (4,005) [961] {481}	20,038 (4,008) [962] {481}
Lubbock	49,364	49,371	49,371	49,371	49,383 (9,877) [2,370] {1,185}	49,394 (9,879) [2,371] {1,185}	49,405 (9,881) [2,371] {1,186}
McLennan	27,581	27,592	27,592	27,592	27,618 (5,524) [1,326] {663}	27,643 (5,529) [1,327] {663}	27,667 (5,533) [1,328] {664}
Montgomery	54,643	54,624	54,624	54,624	54,679 (10,936) [2,625] {1,312}	54,729 (10,946) [2,627] {1,313}	54,777 (10,955) [2,629] {1,315}
Tarrant	261,124	261,163	261,201	261,365	261,490 (52,298) [12,552] {6,276}	261,608 (52,322) [12,557] {6,279}	261,720 (52,344) [12,563] {6,281}
Travis	83,910	83,927	83,945	83,962	84,005 (16,801) [4,032] {2,016}	84,045 (16,809) [4,034] {2,017}	84,084 (16,817) [4,036] {2,018}
Williamson	47,083	47,124	47,165	47,206	47,314 (9,463) [2,271] {1,136}	47,426 (9,485) [2,276] {1,138}	47,543 (9,509) [2,282] {1,141}

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.