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

Date: 6/9/21

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 6/9/21 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.

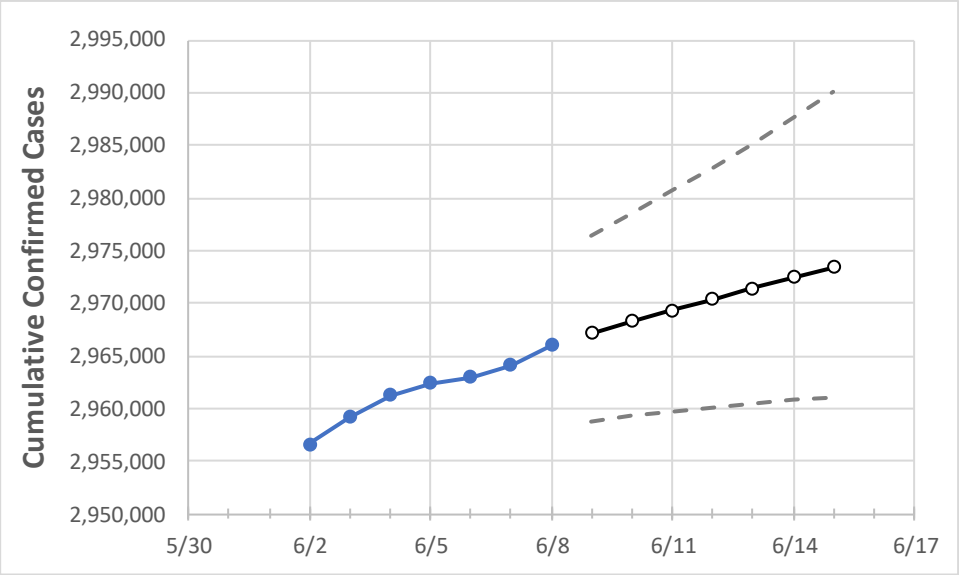
IEM's Modeling Lead

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:						
	6/5	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13	6/14	6/15
Texas	2,962,395	2,962,934	2,964,109	2,966,038	2,967,183	2,968,265	2,969,340	2,970,403	2,971,408	2,972,461	2,973,452

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:						
	6/5	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13	6/14	6/15
Bexar	224,185	224,185	224,185	224,185	224,353	224,522	224,696	224,870	225,039	225,208	225,382
Brazoria	38,231	38,234	38,238	38,241	38,254	38,267	38,280	38,292	38,304	38,315	38,326
Brazos	27,675	27,687	27,699	27,736	27,754	27,773	27,791	27,810	27,830	27,848	27,868
Collin	91,521	91,521	91,521	91,521	91,549	91,577	91,604	91,629	91,653	91,678	91,701
Dallas	303,854	303,921	303,989	304,056	304,125	304,194	304,259	304,323	304,383	304,445	304,506
Denton	76,301	76,322	76,344	76,390	76,417	76,443	76,468	76,494	76,519	76,544	76,567
El Paso	136,208	136,233	136,251	136,257	136,273	136,287	136,301	136,315	136,328	136,339	136,351
Ellis	23,094	23,100	23,106	23,112	23,119	23,125	23,131	23,137	23,143	23,149	23,155
Fort Bend	69,005	69,017	69,029	69,201	69,240	69,278	69,317	69,356	69,391	69,430	69,465
Galveston	40,517	40,551	40,577	40,602	40,622	40,642	40,661	40,679	40,697	40,714	40,731
Harris	401,469	401,812	402,148	402,184	402,374	402,564	402,755	402,946	403,128	403,299	403,477
Hidalgo	91,747	91,775	91,804	91,881	91,925	91,968	92,011	92,052	92,090	92,130	92,165
Johnson	19,998	19,997	20,003	20,008	20,014	20,020	20,026	20,032	20,038	20,043	20,049
Lubbock	49,371	49,378	49,386	49,393	49,398	49,404	49,408	49,414	49,418	49,423	49,427
McLennan	27,592	27,596	27,601	27,605	27,614	27,624	27,633	27,642	27,651	27,659	27,666
Montgomery	54,624	54,688	54,752	54,816	54,855	54,895	54,933	54,970	55,007	55,042	55,079
Tarrant	261,163	261,201	261,365	261,441	261,503	261,564	261,625	261,684	261,743	261,801	261,857
Travis	83,927	83,945	83,962	84,047	84,075	84,101	84,127	84,153	84,181	84,209	84,237
Williamson	47,124	47,165	47,206	47,206	47,257	47,310	47,366	47,423	47,479	47,538	47,599

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:		
	6/5	6/6	6/7	6/8	6/10	6/12	6/14
Bexar	224,185	224,185	224,185	224,185	224,522 (44,904) [10,777] {5,389}	224,870 (44,974) [10,794] {5,397}	225,208 (45,042) [10,810] {5,405}
Brazoria	38,231	38,234	38,238	38,241	38,267 (7,653) [1,837] {918}	38,292 (7,658) [1,838] {919}	38,315 (7,663) [1,839] {920}
Brazos	27,675	27,687	27,699	27,736	27,773 (5,555) [1,333] {667}	27,810 (5,562) [1,335] {667}	27,848 (5,570) [1,337] {668}
Collin	91,521	91,521	91,521	91,521	91,577 (18,315) [4,396] {2,198}	91,629 (18,326) [4,398] {2,199}	91,678 (18,336) [4,401] {2,200}
Dallas	303,854	303,921	303,989	304,056	304,194 (60,839) [14,601] {7,301}	304,323 (60,865) [14,608] {7,304}	304,445 (60,889) [14,613] {7,307}
Denton	76,301	76,322	76,344	76,390	76,443 (15,289) [3,669] {1,835}	76,494 (15,299) [3,672] {1,836}	76,544 (15,309) [3,674] {1,837}
El Paso	136,208	136,233	136,251	136,257	136,287 (27,257) [6,542] {3,271}	136,315 (27,263) [6,543] {3,272}	136,339 (27,268) [6,544] {3,272}
Ellis	23,094	23,100	23,106	23,112	23,125 (4,625) [1,110] {555}	23,137 (4,627) [1,111] {555}	23,149 (4,630) [1,111] {556}
Fort Bend	69,005	69,017	69,029	69,201	69,278 (13,856) [3,325] {1,663}	69,356 (13,871) [3,329] {1,665}	69,430 (13,886) [3,333] {1,666}
Galveston	40,517	40,551	40,577	40,602	40,642 (8,128) [1,951] {975}	40,679 (8,136) [1,953] {976}	40,714 (8,143) [1,954] {977}
Harris	401,469	401,812	402,148	402,184	402,564 (80,513) [19,323] {9,662}	402,946 (80,589) [19,341] {9,671}	403,299 (80,660) [19,358] {9,679}
Hidalgo	91,747	91,775	91,804	91,881	91,968 (18,394) [4,414] {2,207}	92,052 (18,410) [4,418] {2,209}	92,130 (18,426) [4,422] {2,211}
Johnson	19,998	19,997	20,003	20,008	20,020 (4,004) [961] {480}	20,032 (4,006) [962] {481}	20,043 (4,009) [962] {481}
Lubbock	49,371	49,378	49,386	49,393	49,404 (9,881) [2,371] {1,186}	49,414 (9,883) [2,372] {1,186}	49,423 (9,885) [2,372] {1,186}
McLennan	27,592	27,596	27,601	27,605	27,624 (5,525) [1,326] {663}	27,642 (5,528) [1,327] {663}	27,659 (5,532) [1,328] {664}
Montgomery	54,624	54,688	54,752	54,816	54,895 (10,979) [2,635] {1,317}	54,970 (10,994) [2,639] {1,319}	55,042 (11,008) [2,642] {1,321}
Tarrant	261,163	261,201	261,365	261,441	261,564 (52,313) [12,555] {6,278}	261,684 (52,337) [12,561] {6,280}	261,801 (52,360) [12,566] {6,283}
Travis	83,927	83,945	83,962	84,047	84,101 (16,820) [4,037] {2,018}	84,153 (16,831) [4,039] {2,020}	84,209 (16,842) [4,042] {2,021}
Williamson	47,124	47,165	47,206	47,206	47,310 (9,462) [2,271] {1,135}	47,423 (9,485) [2,276] {1,138}	47,538 (9,508) [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.