IEM's AI Modeling: Short-term COVID-19 Projections
Date: 6/10/21

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 <u>not</u> 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 6/10/21 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.
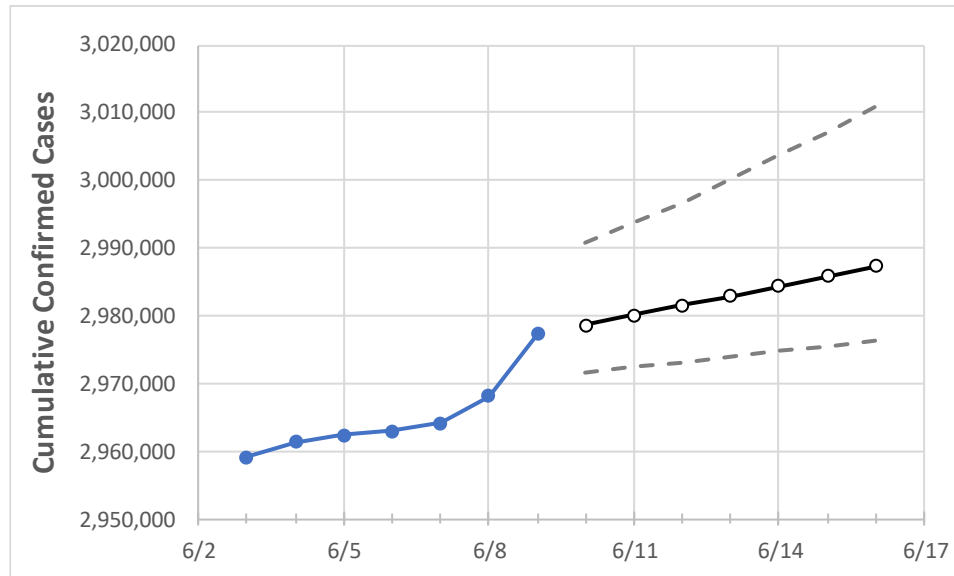
IEM's Modeling Lead

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:						
	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13	6/14	6/15	6/16
Texas	2,962,934	2,964,109	2,968,177	2,977,248	2,978,638	2,980,059	2,981,512	2,982,939	2,984,420	2,985,887	2,987,328

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:						
	6/6	6/7	6/8	6/9	6/10	6/11	6/12	6/13	6/14	6/15	6/16
Bexar	224,378	224,474	224,571	224,667	224,785	224,898	225,010	225,116	225,218	225,318	225,413
Brazoria	38,234	38,238	38,241	38,314	38,332	38,350	38,368	38,386	38,404	38,422	38,439
Brazos	27,687	27,699	27,736	27,756	27,774	27,794	27,813	27,832	27,851	27,872	27,892
Collin	91,521	91,521	91,521	91,521	91,547	91,572	91,595	91,619	91,643	91,664	91,686
Dallas	303,921	303,989	304,056	304,271	304,356	304,444	304,532	304,615	304,699	304,786	304,871
Denton	76,322	76,344	76,390	76,434	76,463	76,492	76,519	76,547	76,574	76,601	76,627
El Paso	136,233	136,251	136,257	136,267	136,281	136,295	136,307	136,319	136,330	136,340	136,350
Ellis	23,100	23,106	23,112	23,119	23,126	23,132	23,138	23,144	23,150	23,156	23,161
Fort Bend	69,017	69,029	69,201	69,232	69,271	69,310	69,348	69,386	69,423	69,459	69,496
Galveston	40,551	40,577	40,602	40,627	40,647	40,666	40,685	40,704	40,722	40,739	40,756
Harris	401,812	402,148	402,184	402,387	402,584	402,775	402,977	403,175	403,369	403,573	403,754
Hidalgo	91,775	91,804	91,881	92,012	92,066	92,119	92,174	92,223	92,275	92,327	92,376
Johnson	19,997	20,003	20,008	20,018	20,025	20,031	20,038	20,044	20,050	20,056	20,062
Lubbock	49,378	49,386	49,393	49,394	49,399	49,405	49,410	49,414	49,419	49,424	49,428
McLennan	27,596	27,601	27,605	27,611	27,620	27,628	27,636	27,644	27,652	27,659	27,666
Montgomery	54,688	54,752	54,816	54,966	55,024	55,084	55,142	55,203	55,264	55,325	55,385
Tarrant	261,201	261,365	261,441	261,507	261,571	261,638	261,703	261,766	261,828	261,887	261,943
Travis	83,945	83,962	84,047	84,072	84,097	84,122	84,147	84,173	84,199	84,223	84,247
Williamson	47,165	47,206	47,206	47,206	47,261	47,316	47,372	47,429	47,489	47,549	47,609

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:		
	6/6	6/7	6/8	6/9	6/11	6/13	6/15
Bexar	224,378	224,474	224,571	224,667	224,898 (44,980) [10,795] {5,398}	225,116 (45,023) [10,806] {5,403}	225,318 (45,064) [10,815] {5,408}
Brazoria	38,234	38,238	38,241	38,314	38,350 (7,670) [1,841] {920}	38,386 (7,677) [1,843] {921}	38,422 (7,684) [1,844] {922}
Brazos	27,687	27,699	27,736	27,756	27,794 (5,559) [1,334] {667}	27,832 (5,566) [1,336] {668}	27,872 (5,574) [1,338] {669}
Collin	91,521	91,521	91,521	91,521	91,572 (18,314) [4,395] {2,198}	91,619 (18,324) [4,398] {2,199}	91,664 (18,333) [4,400] {2,200}
Dallas	303,921	303,989	304,056	304,271	304,444 (60,889) [14,613] {7,307}	304,615 (60,923) [14,622] {7,311}	304,786 (60,957) [14,630] {7,315}
Denton	76,322	76,344	76,390	76,434	76,492 (15,298) [3,672] {1,836}	76,547 (15,309) [3,674] {1,837}	76,601 (15,320) [3,677] {1,838}
El Paso	136,233	136,251	136,257	136,267	136,295 (27,259) [6,542] {3,271}	136,319 (27,264) [6,543] {3,272}	136,340 (27,268) [6,544] {3,272}
Ellis	23,100	23,106	23,112	23,119	23,132 (4,626) [1,110] {555}	23,144 (4,629) [1,111] {555}	23,156 (4,631) [1,111] {556}
Fort Bend	69,017	69,029	69,201	69,232	69,310 (13,862) [3,327] {1,663}	69,386 (13,877) [3,331] {1,665}	69,459 (13,892) [3,334] {1,667}
Galveston	40,551	40,577	40,602	40,627	40,666 (8,133) [1,952] {976}	40,704 (8,141) [1,954] {977}	40,739 (8,148) [1,955] {978}
Harris	401,812	402,148	402,184	402,387	402,775 (80,555) [19,333] {9,667}	403,175 (80,635) [19,352] {9,676}	403,573 (80,715) [19,371] {9,686}
Hidalgo	91,775	91,804	91,881	92,012	92,119 (18,424) [4,422] {2,211}	92,223 (18,445) [4,427] {2,213}	92,327 (18,465) [4,432] {2,216}
Johnson	19,997	20,003	20,008	20,018	20,031 (4,006) [962] {481}	20,044 (4,009) [962] {481}	20,056 (4,011) [963] {481}
Lubbock	49,378	49,386	49,393	49,394	49,405 (9,881) [2,371] {1,186}	49,414 (9,883) [2,372] {1,186}	49,424 (9,885) [2,372] {1,186}
McLennan	27,596	27,601	27,605	27,611	27,628 (5,526) [1,326] {663}	27,644 (5,529) [1,327] {663}	27,659 (5,532) [1,328] {664}
Montgomery	54,688	54,752	54,816	54,966	55,084 (11,017) [2,644] {1,322}	55,203 (11,041) [2,650] {1,325}	55,325 (11,065) [2,656] {1,328}
Tarrant	261,201	261,365	261,441	261,507	261,638 (52,328) [12,559] {6,279}	261,766 (52,353) [12,565] {6,282}	261,887 (52,377) [12,571] {6,285}
Travis	83,945	83,962	84,047	84,072	84,122 (16,824) [4,038] {2,019}	84,173 (16,835) [4,040] {2,020}	84,223 (16,845) [4,043] {2,021}
Williamson	47,165	47,206	47,206	47,206	47,316 (9,463) [2,271] {1,136}	47,429 (9,486) [2,277] {1,138}	47,549 (9,510) [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.