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

Date: 6/17/21

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 6/17/21 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.

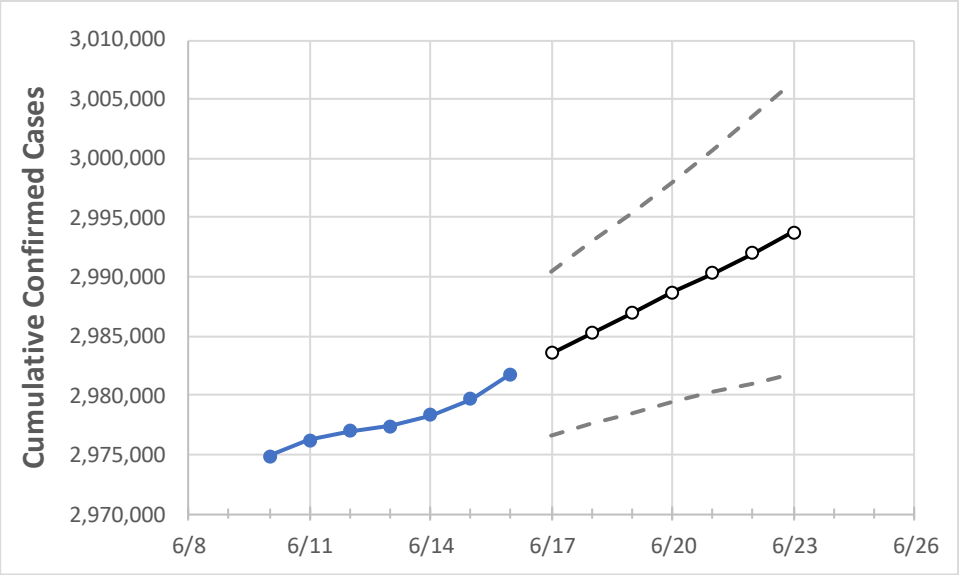
IEM's Modeling Lead

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:						
	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20	6/21	6/22	6/23
Texas	2,977,373	2,978,351	2,979,689	2,981,826	2,983,521	2,985,232	2,986,957	2,988,681	2,990,328	2,992,016	2,993,743

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:						
	6/13	6/14	6/15	6/16	6/17	6/18	6/19	6/20	6/21	6/22	6/23
Bexar	225,170	225,296	225,421	225,547	225,647	225,742	225,838	225,931	226,023	226,113	226,199
Brazoria	38,439	38,440	38,442	38,488	38,508	38,527	38,547	38,567	38,588	38,608	38,628
Brazos	27,785	27,787	27,790	27,840	27,851	27,861	27,871	27,882	27,891	27,901	27,911
Collin	92,251	92,352	92,396	92,413	92,460	92,508	92,556	92,605	92,654	92,702	92,749
Dallas	304,643	304,714	304,903	305,015	305,128	305,241	305,357	305,469	305,586	305,702	305,821
Denton	76,528	76,553	76,613	76,636	76,661	76,685	76,709	76,731	76,754	76,778	76,802
El Paso	136,338	136,343	136,349	136,362	136,371	136,380	136,388	136,395	136,403	136,409	136,415
Ellis	23,170	23,177	23,183	23,183	23,191	23,198	23,206	23,214	23,221	23,229	23,237
Fort Bend	69,388	69,393	69,452	69,511	69,549	69,585	69,624	69,660	69,695	69,732	69,767
Galveston	40,730	40,748	40,766	40,810	40,835	40,861	40,886	40,912	40,937	40,962	40,988
Harris	403,188	403,401	403,496	403,496	403,665	403,830	403,998	404,174	404,337	404,483	404,642
Hidalgo	92,249	92,266	92,357	92,467	92,527	92,587	92,651	92,712	92,775	92,835	92,898
Johnson	20,048	20,054	20,060	20,060	20,066	20,072	20,077	20,083	20,089	20,095	20,100
Lubbock	49,421	49,429	49,437	49,447	49,453	49,459	49,466	49,472	49,478	49,484	49,490
McLennan	27,647	27,654	27,661	27,682	27,688	27,694	27,700	27,706	27,712	27,717	27,723
Montgomery	55,067	55,098	55,129	55,208	55,258	55,308	55,359	55,408	55,456	55,505	55,554
Tarrant	261,854	261,912	261,956	262,098	262,178	262,257	262,336	262,415	262,494	262,571	262,648
Travis	84,206	84,240	84,274	84,303	84,337	84,373	84,409	84,445	84,480	84,516	84,553
Williamson	46,963	46,923	46,882	46,882	46,920	46,957	46,993	47,031	47,067	47,104	47,140

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:		
	6/13	6/14	6/15	6/16	6/18	6/20	6/22
Bexar	225,170	225,296	225,421	225,547	225,742 (45,148) [10,836] {5,418}	225,931 (45,186) [10,845] {5,422}	226,113 (45,223) [10,853] {5,427}
Brazoria	38,439	38,440	38,442	38,488	38,527 (7,705) [1,849] {925}	38,567 (7,713) [1,851] {926}	38,608 (7,722) [1,853] {927}
Brazos	27,785	27,787	27,790	27,840	27,861 (5,572) [1,337] {669}	27,882 (5,576) [1,338] {669}	27,901 (5,580) [1,339] {670}
Collin	92,251	92,352	92,396	92,413	92,508 (18,502) [4,440] {2,220}	92,605 (18,521) [4,445] {2,223}	92,702 (18,540) [4,450] {2,225}
Dallas	304,643	304,714	304,903	305,015	305,241 (61,048) [14,652] {7,326}	305,469 (61,094) [14,662] {7,331}	305,702 (61,140) [14,674] {7,337}
Denton	76,528	76,553	76,613	76,636	76,685 (15,337) [3,681] {1,840}	76,731 (15,346) [3,683] {1,842}	76,778 (15,356) [3,685] {1,843}
El Paso	136,338	136,343	136,349	136,362	136,380 (27,276) [6,546] {3,273}	136,395 (27,279) [6,547] {3,273}	136,409 (27,282) [6,548] {3,274}
Ellis	23,170	23,177	23,183	23,183	23,198 (4,640) [1,114] {557}	23,214 (4,643) [1,114] {557}	23,229 (4,646) [1,115] {557}
Fort Bend	69,388	69,393	69,452	69,511	69,585 (13,917) [3,340] {1,670}	69,660 (13,932) [3,344] {1,672}	69,732 (13,946) [3,347] {1,674}
Galveston	40,730	40,748	40,766	40,810	40,861 (8,172) [1,961] {981}	40,912 (8,182) [1,964] {982}	40,962 (8,192) [1,966] {983}
Harris	403,188	403,401	403,496	403,496	403,830 (80,766) [19,384] {9,692}	404,174 (80,835) [19,400] {9,700}	404,483 (80,897) [19,415] {9,708}
Hidalgo	92,249	92,266	92,357	92,467	92,587 (18,517) [4,444] {2,222}	92,712 (18,542) [4,450] {2,225}	92,835 (18,567) [4,456] {2,228}
Johnson	20,048	20,054	20,060	20,060	20,072 (4,014) [963] {482}	20,083 (4,017) [964] {482}	20,095 (4,019) [965] {482}
Lubbock	49,421	49,429	49,437	49,447	49,459 (9,892) [2,374] {1,187}	49,472 (9,894) [2,375] {1,187}	49,484 (9,897) [2,375] {1,188}
McLennan	27,647	27,654	27,661	27,682	27,694 (5,539) [1,329] {665}	27,706 (5,541) [1,330] {665}	27,717 (5,543) [1,330] {665}
Montgomery	55,067	55,098	55,129	55,208	55,308 (11,062) [2,655] {1,327}	55,408 (11,082) [2,660] {1,330}	55,505 (11,101) [2,664] {1,332}
Tarrant	261,854	261,912	261,956	262,098	262,257 (52,451) [12,588] {6,294}	262,415 (52,483) [12,596] {6,298}	262,571 (52,514) [12,603] {6,302}
Travis	84,206	84,240	84,274	84,303	84,373 (16,875) [4,050] {2,025}	84,445 (16,889) [4,053] {2,027}	84,516 (16,903) [4,057] {2,028}
Williamson	46,963	46,923	46,882	46,882	46,957 (9,391) [2,254] {1,127}	47,031 (9,406) [2,257] {1,129}	47,104 (9,421) [2,261] {1,130}

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.