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

Date: 5/24/21

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 5/24/21 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.

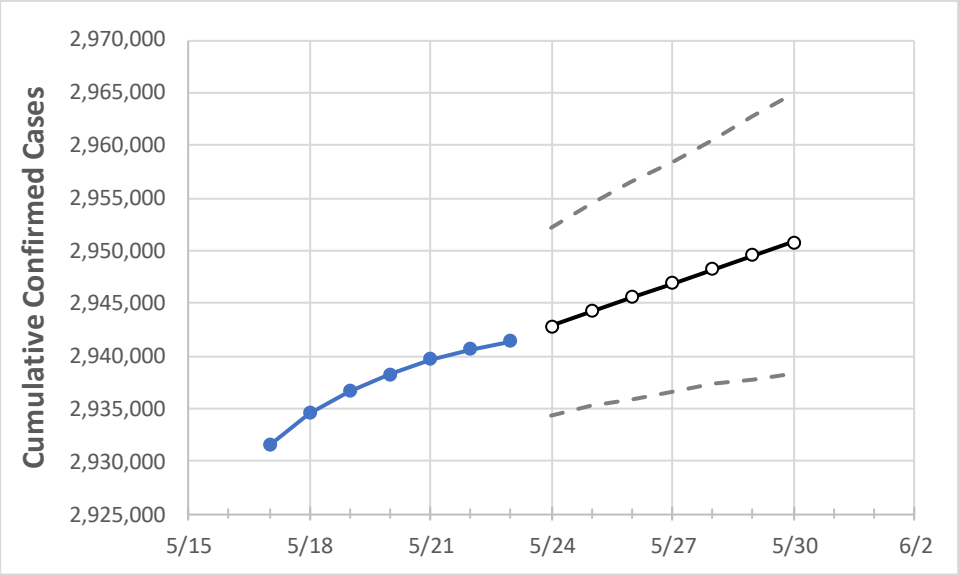
IEM's Modeling Lead

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:						
	5/20	5/21	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30
Texas	2,938,261	2,939,697	2,940,679	2,941,389	2,942,808	2,944,265	2,945,615	2,946,941	2,948,247	2,949,523	2,950,775

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:						
	5/20	5/21	5/22	5/23	5/24	5/25	5/26	5/27	5/28	5/29	5/30
Bexar	221,603	221,664	221,664	221,664	221,781	221,889	221,997	222,100	222,196	222,287	222,377
Brazoria	37,972	37,970	37,962	37,962	37,992	38,023	38,053	38,082	38,111	38,138	38,165
Brazos	26,813	26,821	26,828	26,828	26,841	26,852	26,864	26,875	26,886	26,896	26,906
Collin	91,182	91,221	91,277	91,337	91,380	91,424	91,465	91,502	91,542	91,578	91,612
Dallas	302,240	302,368	302,425	302,450	302,554	302,654	302,745	302,839	302,927	303,012	303,100
Denton	75,656	75,693	75,693	75,693	75,744	75,795	75,845	75,892	75,940	75,987	76,033
El Paso	135,758	135,804	135,843	135,880	135,941	135,999	136,058	136,115	136,172	136,224	136,276
Ellis	22,942	22,947	22,963	22,963	22,975	22,987	22,999	23,012	23,024	23,036	23,048
Fort Bend	68,369	68,394	68,394	68,394	68,447	68,498	68,547	68,597	68,646	68,691	68,737
Galveston	40,025	40,073	40,123	40,156	40,203	40,248	40,293	40,338	40,383	40,427	40,472
Harris	397,578	397,751	398,013	398,276	398,451	398,617	398,782	398,941	399,092	399,242	399,389
Hidalgo	90,675	90,738	90,738	90,738	90,839	90,937	91,035	91,140	91,244	91,345	91,452
Johnson	19,885	19,887	19,891	19,891	19,915	19,941	19,966	19,995	20,025	20,056	20,087
Lubbock	49,223	49,238	49,253	49,253	49,269	49,284	49,299	49,314	49,329	49,344	49,360
McLennan	27,333	27,356	27,356	27,356	27,370	27,383	27,397	27,410	27,424	27,437	27,450
Montgomery	53,976	54,013	54,013	54,013	54,065	54,116	54,164	54,212	54,258	54,302	54,345
Tarrant	259,847	259,949	260,020	260,090	260,204	260,307	260,411	260,517	260,625	260,725	260,829
Travis	83,495	83,524	83,524	83,524	83,560	83,595	83,630	83,663	83,696	83,728	83,759
Williamson	46,497	46,528	46,528	46,528	46,561	46,593	46,623	46,651	46,679	46,706	46,733

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:		
	5/20	5/21	5/22	5/23	5/25	5/27	5/29
Bexar	221,603	221,664	221,664	221,664	221,889 (44,378) [10,651] {5,325}	222,100 (44,420) [10,661] {5,330}	222,287 (44,457) [10,670] {5,335}
Brazoria	37,972	37,970	37,962	37,962	38,023 (7,605) [1,825] {913}	38,082 (7,616) [1,828] {914}	38,138 (7,628) [1,831] {915}
Brazos	26,813	26,821	26,828	26,828	26,852 (5,370) [1,289] {644}	26,875 (5,375) [1,290] {645}	26,896 (5,379) [1,291] {646}
Collin	91,182	91,221	91,277	91,337	91,424 (18,285) [4,388] {2,194}	91,502 (18,300) [4,392] {2,196}	91,578 (18,316) [4,396] {2,198}
Dallas	302,240	302,368	302,425	302,450	302,654 (60,531) [14,527] {7,264}	302,839 (60,568) [14,536] {7,268}	303,012 (60,602) [14,545] {7,272}
Denton	75,656	75,693	75,693	75,693	75,795 (15,159) [3,638] {1,819}	75,892 (15,178) [3,643] {1,821}	75,987 (15,197) [3,647] {1,824}
El Paso	135,758	135,804	135,843	135,880	135,999 (27,200) [6,528] {3,264}	136,115 (27,223) [6,534] {3,267}	136,224 (27,245) [6,539] {3,269}
Ellis	22,942	22,947	22,963	22,963	22,987 (4,597) [1,103] {552}	23,012 (4,602) [1,105] {552}	23,036 (4,607) [1,106] {553}
Fort Bend	68,369	68,394	68,394	68,394	68,498 (13,700) [3,288] {1,644}	68,597 (13,719) [3,293] {1,646}	68,691 (13,738) [3,297] {1,649}
Galveston	40,025	40,073	40,123	40,156	40,248 (8,050) [1,932] {966}	40,338 (8,068) [1,936] {968}	40,427 (8,085) [1,941] {970}
Harris	397,578	397,751	398,013	398,276	398,617 (79,723) [19,134] {9,567}	398,941 (79,788) [19,149] {9,575}	399,242 (79,848) [19,164] {9,582}
Hidalgo	90,675	90,738	90,738	90,738	90,937 (18,187) [4,365] {2,182}	91,140 (18,228) [4,375] {2,187}	91,345 (18,269) [4,385] {2,192}
Johnson	19,885	19,887	19,891	19,891	19,941 (3,988) [957] {479}	19,995 (3,999) [960] {480}	20,056 (4,011) [963] {481}
Lubbock	49,223	49,238	49,253	49,253	49,284 (9,857) [2,366] {1,183}	49,314 (9,863) [2,367] {1,184}	49,344 (9,869) [2,369] {1,184}
McLennan	27,333	27,356	27,356	27,356	27,383 (5,477) [1,314] {657}	27,410 (5,482) [1,316] {658}	27,437 (5,487) [1,317] {658}
Montgomery	53,976	54,013	54,013	54,013	54,116 (10,823) [2,598] {1,299}	54,212 (10,842) [2,602] {1,301}	54,302 (10,860) [2,607] {1,303}
Tarrant	259,847	259,949	260,020	260,090	260,307 (52,061) [12,495] {6,247}	260,517 (52,103) [12,505] {6,252}	260,725 (52,145) [12,515] {6,257}
Travis	83,495	83,524	83,524	83,524	83,595 (16,719) [4,013] {2,006}	83,663 (16,733) [4,016] {2,008}	83,728 (16,746) [4,019] {2,009}
Williamson	46,497	46,528	46,528	46,528	46,593 (9,319) [2,236] {1,118}	46,651 (9,330) [2,239] {1,120}	46,706 (9,341) [2,242] {1,121}

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.