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

Date: 5/14/21

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 5/14/21 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.

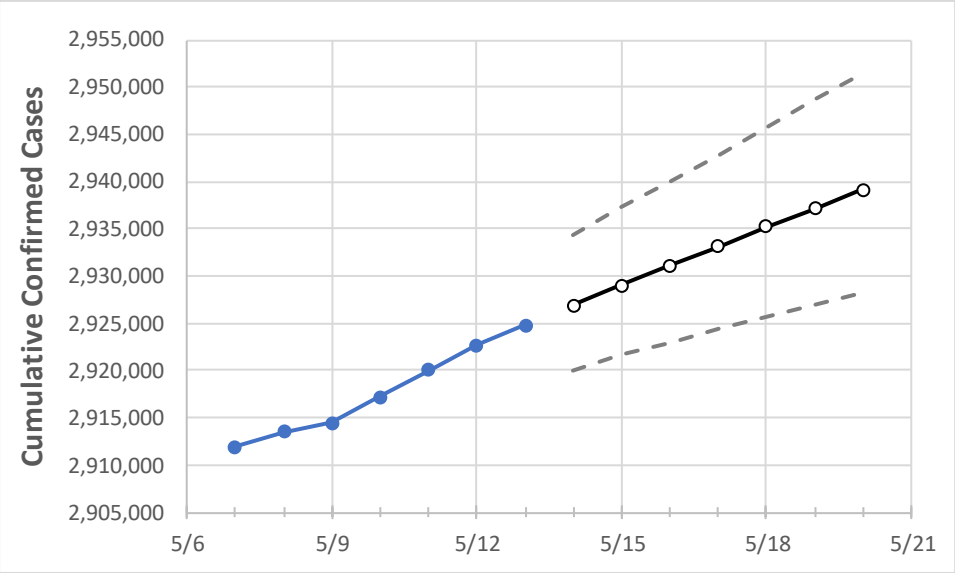
IEM's Modeling Lead

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:						
	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18	5/19	5/20
Texas	2,917,219	2,920,043	2,922,680	2,924,766	2,926,945	2,929,053	2,931,115	2,933,172	2,935,236	2,937,181	2,939,105

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:						
	5/10	5/11	5/12	5/13	5/14	5/15	5/16	5/17	5/18	5/19	5/20
Bexar	219,929	220,054	220,252	220,252	220,433	220,604	220,775	220,939	221,100	221,256	221,406
Brazoria	37,645	37,677	37,710	37,728	37,768	37,808	37,849	37,889	37,928	37,967	38,005
Brazos	26,621	26,658	26,701	26,701	26,730	26,759	26,787	26,817	26,845	26,873	26,901
Collin	90,567	90,685	90,693	90,804	90,870	90,936	90,999	91,063	91,124	91,186	91,244
Dallas	300,627	300,786	301,025	301,310	301,492	301,671	301,846	302,027	302,201	302,370	302,541
Denton	74,992	75,133	75,225	75,307	75,382	75,459	75,536	75,614	75,691	75,768	75,845
El Paso	134,860	134,925	135,186	135,229	135,311	135,390	135,468	135,546	135,622	135,695	135,772
Ellis	22,786	22,797	22,805	22,814	22,824	22,833	22,841	22,850	22,858	22,865	22,872
Fort Bend	67,605	67,750	67,855	67,933	68,018	68,102	68,186	68,268	68,351	68,431	68,510
Galveston	39,510	39,551	39,599	39,683	39,737	39,791	39,846	39,899	39,952	40,005	40,058
Harris	395,522	395,655	395,975	395,975	396,216	396,452	396,682	396,914	397,126	397,351	397,565
Hidalgo	89,517	89,563	89,761	89,953	90,061	90,172	90,284	90,394	90,506	90,618	90,731
Johnson	19,790	19,795	19,606	19,611	19,618	19,624	19,631	19,637	19,644	19,650	19,656
Lubbock	49,063	49,079	49,095	49,122	49,145	49,169	49,194	49,218	49,245	49,271	49,299
McLennan	27,168	27,183	27,196	27,224	27,244	27,264	27,284	27,304	27,322	27,341	27,360
Montgomery	53,251	53,338	53,412	53,505	53,583	53,657	53,733	53,808	53,883	53,954	54,024
Tarrant	258,423	258,519	258,693	258,906	259,055	259,203	259,351	259,502	259,649	259,799	259,952
Travis	83,002	83,062	83,145	83,201	83,261	83,320	83,377	83,433	83,488	83,542	83,594
Williamson	46,057	46,131	46,184	46,184	46,244	46,303	46,361	46,420	46,478	46,535	46,592

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:		
	5/10	5/11	5/12	5/13	5/15	5/17	5/19
Bexar	219,929	220,054	220,252	220,252	220,604 (44,121) [10,589] {5,294}	220,939 (44,188) [10,605] {5,303}	221,256 (44,251) [10,620] {5,310}
Brazoria	37,645	37,677	37,710	37,728	37,808 (7,562) [1,815] {907}	37,889 (7,578) [1,819] {909}	37,967 (7,593) [1,822] {911}
Brazos	26,621	26,658	26,701	26,701	26,759 (5,352) [1,284] {642}	26,817 (5,363) [1,287] {644}	26,873 (5,375) [1,290] {645}
Collin	90,567	90,685	90,693	90,804	90,936 (18,187) [4,365] {2,182}	91,063 (18,213) [4,371] {2,186}	91,186 (18,237) [4,377] {2,188}
Dallas	300,627	300,786	301,025	301,310	301,671 (60,334) [14,480] {7,240}	302,027 (60,405) [14,497] {7,249}	302,370 (60,474) [14,514] {7,257}
Denton	74,992	75,133	75,225	75,307	75,459 (15,092) [3,622] {1,811}	75,614 (15,123) [3,629] {1,815}	75,768 (15,154) [3,637] {1,818}
El Paso	134,860	134,925	135,186	135,229	135,390 (27,078) [6,499] {3,249}	135,546 (27,109) [6,506] {3,253}	135,695 (27,139) [6,513] {3,257}
Ellis	22,786	22,797	22,805	22,814	22,833 (4,567) [1,096] {548}	22,850 (4,570) [1,097] {548}	22,865 (4,573) [1,098] {549}
Fort Bend	67,605	67,750	67,855	67,933	68,102 (13,620) [3,269] {1,634}	68,268 (13,654) [3,277] {1,638}	68,431 (13,686) [3,285] {1,642}
Galveston	39,510	39,551	39,599	39,683	39,791 (7,958) [1,910] {955}	39,899 (7,980) [1,915] {958}	40,005 (8,001) [1,920] {960}
Harris	395,522	395,655	395,975	395,975	396,452 (79,290) [19,030] {9,515}	396,914 (79,383) [19,052] {9,526}	397,351 (79,470) [19,073] {9,536}
Hidalgo	89,517	89,563	89,761	89,953	90,172 (18,034) [4,328] {2,164}	90,394 (18,079) [4,339] {2,169}	90,618 (18,124) [4,350] {2,175}
Johnson	19,790	19,795	19,606	19,611	19,624 (3,925) [942] {471}	19,637 (3,927) [943] {471}	19,650 (3,930) [943] {472}
Lubbock	49,063	49,079	49,095	49,122	49,169 (9,834) [2,360] {1,180}	49,218 (9,844) [2,362] {1,181}	49,271 (9,854) [2,365] {1,183}
McLennan	27,168	27,183	27,196	27,224	27,264 (5,453) [1,309] {654}	27,304 (5,461) [1,311] {655}	27,341 (5,468) [1,312] {656}
Montgomery	53,251	53,338	53,412	53,505	53,657 (10,731) [2,576] {1,288}	53,808 (10,762) [2,583] {1,291}	53,954 (10,791) [2,590] {1,295}
Tarrant	258,423	258,519	258,693	258,906	259,203 (51,841) [12,442] {6,221}	259,502 (51,900) [12,456] {6,228}	259,799 (51,960) [12,470] {6,235}
Travis	83,002	83,062	83,145	83,201	83,320 (16,664) [3,999] {2,000}	83,433 (16,687) [4,005] {2,002}	83,542 (16,708) [4,010] {2,005}
Williamson	46,057	46,131	46,184	46,184	46,303 (9,261) [2,223] {1,111}	46,420 (9,284) [2,228] {1,114}	46,535 (9,307) [2,234] {1,117}

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.