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

Date: 7/7/21

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 7/7/21 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.

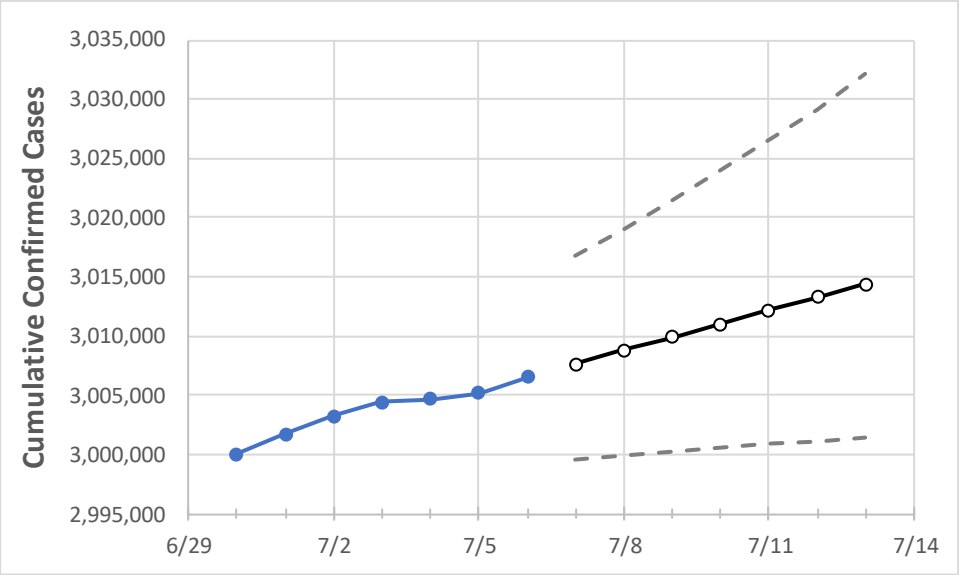
IEM's Modeling Lead

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:						
	7/3	7/4	7/5	7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13
Texas	3,004,465	3,004,684	3,005,221	3,006,541	3,007,629	3,008,772	3,009,907	3,011,042	3,012,153	3,013,245	3,014,410

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:						
	7/3	7/4	7/5	7/6	7/7	7/8	7/9	7/10	7/11	7/12	7/13
Bexar	227,474	227,474	227,474	227,474	227,519	227,562	227,603	227,640	227,675	227,706	227,735
Brazoria	38,835	38,833	38,833	38,833	38,866	38,902	38,937	38,973	39,012	39,056	39,097
Brazos	28,048	28,052	28,057	28,061	28,069	28,077	28,086	28,093	28,101	28,109	28,118
Collin	93,113	93,149	93,173	93,283	93,339	93,397	93,461	93,522	93,591	93,658	93,731
Dallas	306,911	306,952	306,992	307,033	307,127	307,221	307,315	307,410	307,503	307,592	307,683
Denton	77,130	77,148	77,167	77,185	77,208	77,231	77,254	77,276	77,297	77,319	77,340
El Paso	136,692	136,703	136,711	136,740	136,760	136,779	136,799	136,819	136,839	136,859	136,879
Ellis	23,151	23,152	23,152	23,153	23,159	23,165	23,171	23,177	23,183	23,188	23,194
Fort Bend	70,036	70,039	70,043	70,046	70,061	70,073	70,086	70,098	70,111	70,123	70,133
Galveston	41,239	41,239	41,239	41,239	41,272	41,308	41,343	41,381	41,422	41,464	41,507
Harris	403,512	403,584	403,645	403,646	403,729	403,809	403,886	403,969	404,040	404,121	404,191
Hidalgo	93,606	93,618	93,629	93,640	93,686	93,731	93,776	93,818	93,861	93,901	93,941
Johnson	20,204	20,208	20,212	20,216	20,223	20,231	20,239	20,247	20,255	20,263	20,272
Lubbock	49,534	49,534	49,534	49,534	49,543	49,552	49,561	49,571	49,582	49,592	49,603
McLennan	27,716	27,716	27,716	27,716	27,717	27,717	27,717	27,718	27,718	27,718	27,719
Montgomery	55,665	55,665	55,665	55,665	55,692	55,717	55,743	55,769	55,796	55,821	55,846
Tarrant	263,707	263,724	263,740	263,757	263,803	263,848	263,890	263,931	263,971	264,008	264,047
Travis	84,854	84,865	84,877	84,888	84,911	84,935	84,959	84,982	85,005	85,028	85,049
Williamson	47,285	47,314	47,343	47,343	47,374	47,405	47,438	47,472	47,507	47,542	47,579

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:		
	7/3	7/4	7/5	7/6	7/8	7/10	7/12
Bexar	227,474	227,474	227,474	227,474	227,562 (45,512) [10,923] {5,461}	227,640 (45,528) [10,927] {5,463}	227,706 (45,541) [10,930] {5,465}
Brazoria	38,835	38,833	38,833	38,833	38,902 (7,780) [1,867] {934}	38,973 (7,795) [1,871] {935}	39,056 (7,811) [1,875] {937}
Brazos	28,048	28,052	28,057	28,061	28,077 (5,615) [1,348] {674}	28,093 (5,619) [1,348] {674}	28,109 (5,622) [1,349] {675}
Collin	93,113	93,149	93,173	93,283	93,397 (18,679) [4,483] {2,242}	93,522 (18,704) [4,489] {2,245}	93,658 (18,732) [4,496] {2,248}
Dallas	306,911	306,952	306,992	307,033	307,221 (61,444) [14,747] {7,373}	307,410 (61,482) [14,756] {7,378}	307,592 (61,518) [14,764] {7,382}
Denton	77,130	77,148	77,167	77,185	77,231 (15,446) [3,707] {1,854}	77,276 (15,455) [3,709] {1,855}	77,319 (15,464) [3,711] {1,856}
El Paso	136,692	136,703	136,711	136,740	136,779 (27,356) [6,565] {3,283}	136,819 (27,364) [6,567] {3,284}	136,859 (27,372) [6,569] {3,285}
Ellis	23,151	23,152	23,152	23,153	23,165 (4,633) [1,112] {556}	23,177 (4,635) [1,112] {556}	23,188 (4,638) [1,113] {557}
Fort Bend	70,036	70,039	70,043	70,046	70,073 (14,015) [3,364] {1,682}	70,098 (14,020) [3,365] {1,682}	70,123 (14,025) [3,366] {1,683}
Galveston	41,239	41,239	41,239	41,239	41,308 (8,262) [1,983] {991}	41,381 (8,276) [1,986] {993}	41,464 (8,293) [1,990] {995}
Harris	403,512	403,584	403,645	403,646	403,809 (80,762) [19,383] {9,691}	403,969 (80,794) [19,391] {9,695}	404,121 (80,824) [19,398] {9,699}
Hidalgo	93,606	93,618	93,629	93,640	93,731 (18,746) [4,499] {2,250}	93,818 (18,764) [4,503] {2,252}	93,901 (18,780) [4,507] {2,254}
Johnson	20,204	20,208	20,212	20,216	20,231 (4,046) [971] {486}	20,247 (4,049) [972] {486}	20,263 (4,053) [973] {486}
Lubbock	49,534	49,534	49,534	49,534	49,552 (9,910) [2,379] {1,189}	49,571 (9,914) [2,379] {1,190}	49,592 (9,918) [2,380] {1,190}
McLennan	27,716	27,716	27,716	27,716	27,717 (5,543) [1,330] {665}	27,718 (5,544) [1,330] {665}	27,718 (5,544) [1,330] {665}
Montgomery	55,665	55,665	55,665	55,665	55,717 (11,143) [2,674] {1,337}	55,769 (11,154) [2,677] {1,338}	55,821 (11,164) [2,679] {1,340}
Tarrant	263,707	263,724	263,740	263,757	263,848 (52,770) [12,665] {6,332}	263,931 (52,786) [12,669] {6,334}	264,008 (52,802) [12,672] {6,336}
Travis	84,854	84,865	84,877	84,888	84,935 (16,987) [4,077] {2,038}	84,982 (16,996) [4,079] {2,040}	85,028 (17,006) [4,081] {2,041}
Williamson	47,285	47,314	47,343	47,343	47,405 (9,481) [2,275] {1,138}	47,472 (9,494) [2,279] {1,139}	47,542 (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.