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

Date: 10/9/20

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 10/9/20 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.

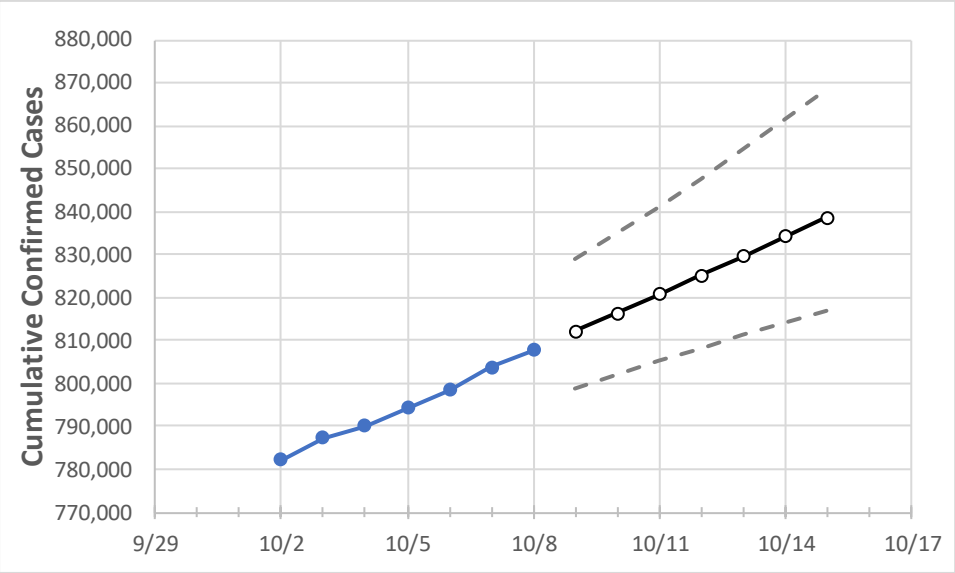
IEM's Modeling Lead

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:						
	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12	10/13	10/14	10/15
Texas	794,319	798,569	803,690	807,754	812,067	816,412	820,790	825,199	829,640	834,111	838,613

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 20%, and are often within 10%, of actual confirmed cases.

Texas Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	10/5	10/6	10/7	10/8	10/9	10/10	10/11	10/12	10/13	10/14	10/15
Bexar	58,746	58,950	59,153	59,323	59,495	59,667	59,839	60,012	60,185	60,358	60,532
Brazoria	11,589	11,603	11,658	11,691	11,714	11,735	11,756	11,776	11,795	11,814	11,831
Brazos	6,686	6,725	6,794	6,901	6,948	6,995	7,043	7,092	7,141	7,190	7,240
Collin	15,610	15,736	15,814	15,923	16,011	16,099	16,189	16,279	16,370	16,462	16,555
Dallas	84,245	84,491	84,951	85,189	85,533	85,879	86,229	86,582	86,937	87,295	87,657
Denton	12,508	12,567	12,646	12,720	12,776	12,832	12,887	12,943	12,998	13,054	13,109
El Paso	25,793	26,030	26,432	26,969	27,339	27,728	28,139	28,571	29,027	29,507	30,012
Ellis	4,483	4,484	4,523	4,536	4,541	4,545	4,549	4,553	4,557	4,560	4,564
Fort Bend	16,620	16,642	16,703	16,712	16,737	16,762	16,786	16,810	16,833	16,856	16,879
Galveston	11,798	11,807	11,833	11,851	11,870	11,888	11,907	11,925	11,943	11,961	11,979
Harris	148,235	148,769	149,394	149,771	150,336	150,897	151,454	152,008	152,557	153,103	153,645
Hidalgo	32,630	32,813	33,018	33,148	33,258	33,369	33,481	33,593	33,706	33,819	33,933
Johnson	3,187	3,196	3,234	3,256	3,274	3,293	3,311	3,330	3,348	3,367	3,385
Lubbock	12,640	12,766	12,939	13,070	13,222	13,376	13,533	13,692	13,854	14,018	14,185
McLennan	8,411	8,583	8,642	8,716	8,777	8,839	8,902	8,965	9,029	9,094	9,160
Montgomery	11,444	11,682	11,855	12,022	12,097	12,174	12,252	12,332	12,413	12,496	12,580
Tarrant	52,366	52,720	53,292	53,838	54,278	54,726	55,182	55,647	56,121	56,603	57,095
Travis	29,857	29,952	29,997	30,075	30,144	30,213	30,280	30,347	30,413	30,479	30,544
Williamson	8,802	8,861	8,882	8,894	8,916	8,938	8,960	8,982	9,004	9,026	9,048

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:		
	10/5	10/6	10/7	10/8	10/10	10/12	10/14
Bexar	58,746	58,950	59,153	59,323	59,667 (11,933) [2,864] {1,432}	60,012 (12,002) [2,881] {1,440}	60,358 (12,072) [2,897] {1,449}
Brazoria	11,589	11,603	11,658	11,691	11,735 (2,347) [563] {282}	11,776 (2,355) [565] {283}	11,814 (2,363) [567] {284}
Brazos	6,686	6,725	6,794	6,901	6,995 (1,399) [336] {168}	7,092 (1,418) [340] {170}	7,190 (1,438) [345] {173}
Collin	15,610	15,736	15,814	15,923	16,099 (3,220) [773] {386}	16,279 (3,256) [781] {391}	16,462 (3,292) [790] {395}
Dallas	84,245	84,491	84,951	85,189	85,879 (17,176) [4,122] {2,061}	86,582 (17,316) [4,156] {2,078}	87,295 (17,459) [4,190] {2,095}
Denton	12,508	12,567	12,646	12,720	12,832 (2,566) [616] {308}	12,943 (2,589) [621] {311}	13,054 (2,611) [627] {313}
El Paso	25,793	26,030	26,432	26,969	27,728 (5,546) [1,331] {665}	28,571 (5,714) [1,371] {686}	29,507 (5,901) [1,416] {708}
Ellis	4,483	4,484	4,523	4,536	4,545 (909) [218] {109}	4,553 (911) [219] {109}	4,560 (912) [219] {109}
Fort Bend	16,620	16,642	16,703	16,712	16,762 (3,352) [805] {402}	16,810 (3,362) [807] {403}	16,856 (3,371) [809] {405}
Galveston	11,798	11,807	11,833	11,851	11,888 (2,378) [571] {285}	11,925 (2,385) [572] {286}	11,961 (2,392) [574] {287}
Harris	148,235	148,769	149,394	149,771	150,897 (30,179) [7,243] {3,622}	152,008 (30,402) [7,296] {3,648}	153,103 (30,621) [7,349] {3,674}
Hidalgo	32,630	32,813	33,018	33,148	33,369 (6,674) [1,602] {801}	33,593 (6,719) [1,612] {806}	33,819 (6,764) [1,623] {812}
Johnson	3,187	3,196	3,234	3,256	3,293 (659) [158] {79}	3,330 (666) [160] {80}	3,367 (673) [162] {81}
Lubbock	12,640	12,766	12,939	13,070	13,376 (2,675) [642] {321}	13,692 (2,738) [657] {329}	14,018 (2,804) [673] {336}
McLennan	8,411	8,583	8,642	8,716	8,839 (1,768) [424] {212}	8,965 (1,793) [430] {215}	9,094 (1,819) [437] {218}
Montgomery	11,444	11,682	11,855	12,022	12,174 (2,435) [584] {292}	12,332 (2,466) [592] {296}	12,496 (2,499) [600] {300}
Tarrant	52,366	52,720	53,292	53,838	54,726 (10,945) [2,627] {1,313}	55,647 (11,129) [2,671] {1,336}	56,603 (11,321) [2,717] {1,358}
Travis	29,857	29,952	29,997	30,075	30,213 (6,043) [1,450] {725}	30,347 (6,069) [1,457] {728}	30,479 (6,096) [1,463] {731}
Williamson	8,802	8,861	8,882	8,894	8,938 (1,788) [429] {215}	8,982 (1,796) [431] {216}	9,026 (1,805) [433] {217}

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.