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

Date: 12/1/20

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 12/1/20 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.

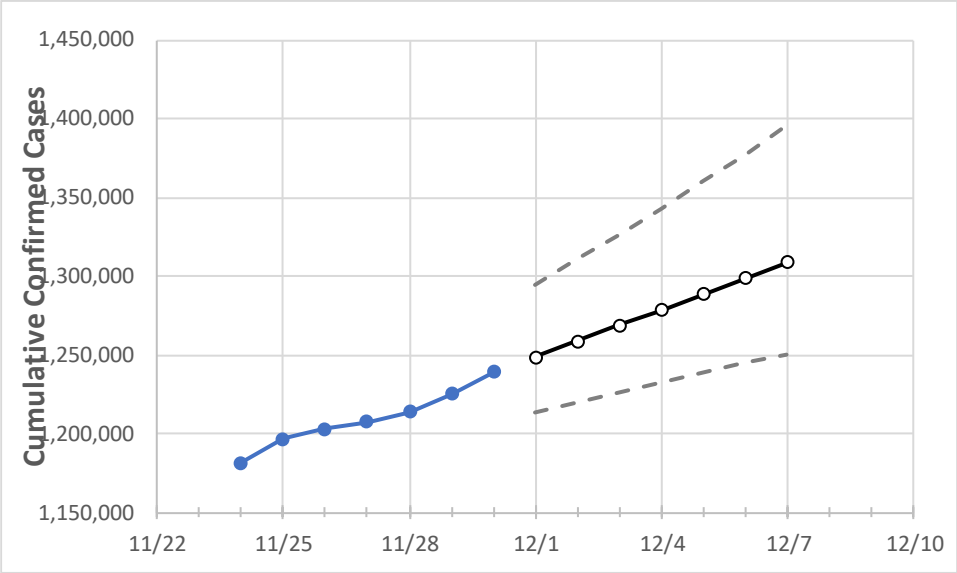
IEM's Modeling Lead

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:						
	11/27	11/28	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7
Texas	1,207,243	1,213,577	1,225,118	1,238,752	1,248,695	1,258,647	1,268,609	1,278,580	1,288,561	1,298,552	1,308,553

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:						
	11/27	11/28	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6	12/7
Bexar	77,857	78,411	80,057	81,174	82,326	83,564	84,895	86,325	87,862	89,512	91,284
Brazoria	14,205	14,255	14,389	14,511	14,609	14,711	14,818	14,928	15,044	15,164	15,290
Brazos	10,974	10,998	11,021	11,094	11,136	11,177	11,216	11,254	11,291	11,327	11,361
Collin	25,153	25,566	26,192	26,600	26,973	27,373	27,804	28,267	28,764	29,298	29,872
Dallas	134,466	134,793	137,096	138,798	139,647	140,487	141,318	142,139	142,951	143,754	144,548
Denton	23,094	23,276	23,460	23,644	23,905	24,169	24,436	24,705	24,977	25,252	25,529
El Paso	84,683	85,318	85,696	86,172	86,616	87,034	87,427	87,796	88,143	88,470	88,776
Ellis	6,851	6,875	6,898	6,898	6,964	7,033	7,103	7,176	7,251	7,328	7,407
Fort Bend	20,286	20,440	20,504	20,567	20,714	20,866	21,023	21,187	21,356	21,532	21,714
Galveston	14,550	14,635	14,691	14,961	15,073	15,189	15,309	15,434	15,564	15,698	15,838
Harris	187,867	187,932	190,631	191,513	192,023	192,522	193,011	193,489	193,957	194,416	194,866
Hidalgo	42,844	42,903	42,961	43,020	43,286	43,555	43,830	44,108	44,391	44,679	44,971
Johnson	5,354	5,380	5,407	5,407	5,470	5,534	5,600	5,666	5,733	5,801	5,870
Lubbock	30,911	31,499	31,858	32,236	32,703	33,175	33,651	34,131	34,616	35,105	35,599
McLennan	14,029	14,029	14,029	14,029	14,286	14,553	14,831	15,121	15,422	15,736	16,063
Montgomery	17,355	17,542	17,728	17,915	18,171	18,439	18,719	19,011	19,316	19,635	19,968
Tarrant	96,642	96,968	97,294	100,650	101,381	102,095	102,794	103,476	104,143	104,795	105,432
Travis	37,666	37,898	38,045	38,377	38,633	38,893	39,156	39,423	39,693	39,967	40,244
Williamson	12,787	12,958	13,130	13,301	13,548	13,812	14,094	14,397	14,721	15,067	15,438

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:		
	11/27	11/28	11/29	11/30	12/2	12/4	12/6
Bexar	77,857	78,411	80,057	81,174	83,564 (16,713) [4,011] {2,006}	86,325 (17,265) [4,144] {2,072}	89,512 (17,902) [4,297] {2,148}
Brazoria	14,205	14,255	14,389	14,511	14,711 (2,942) [706] {353}	14,928 (2,986) [717] {358}	15,164 (3,033) [728] {364}
Brazos	10,974	10,998	11,021	11,094	11,177 (2,235) [536] {268}	11,254 (2,251) [540] {270}	11,327 (2,265) [544] {272}
Collin	25,153	25,566	26,192	26,600	27,373 (5,475) [1,314] {657}	28,267 (5,653) [1,357] {678}	29,298 (5,860) [1,406] {703}
Dallas	134,466	134,793	137,096	138,798	140,487 (28,097) [6,743] {3,372}	142,139 (28,428) [6,823] {3,411}	143,754 (28,751) [6,900] {3,450}
Denton	23,094	23,276	23,460	23,644	24,169 (4,834) [1,160] {580}	24,705 (4,941) [1,186] {593}	25,252 (5,050) [1,212] {606}
El Paso	84,683	85,318	85,696	86,172	87,034 (17,407) [4,178] {2,089}	87,796 (17,559) [4,214] {2,107}	88,470 (17,694) [4,247] {2,123}
Ellis	6,851	6,875	6,898	6,898	7,033 (1,407) [338] {169}	7,176 (1,435) [344] {172}	7,328 (1,466) [352] {176}
Fort Bend	20,286	20,440	20,504	20,567	20,866 (4,173) [1,002] {501}	21,187 (4,237) [1,017] {508}	21,532 (4,306) [1,034] {517}
Galveston	14,550	14,635	14,691	14,961	15,189 (3,038) [729] {365}	15,434 (3,087) [741] {370}	15,698 (3,140) [754] {377}
Harris	187,867	187,932	190,631	191,513	192,522 (38,504) [9,241] {4,621}	193,489 (38,698) [9,287] {4,644}	194,416 (38,883) [9,332] {4,666}
Hidalgo	42,844	42,903	42,961	43,020	43,555 (8,711) [2,091] {1,045}	44,108 (8,822) [2,117] {1,059}	44,679 (8,936) [2,145] {1,072}
Johnson	5,354	5,380	5,407	5,407	5,534 (1,107) [266] {133}	5,666 (1,133) [272] {136}	5,801 (1,160) [278] {139}
Lubbock	30,911	31,499	31,858	32,236	33,175 (6,635) [1,592] {796}	34,131 (6,826) [1,638] {819}	35,105 (7,021) [1,685] {843}
McLennan	14,029	14,029	14,029	14,029	14,553 (2,911) [699] {349}	15,121 (3,024) [726] {363}	15,736 (3,147) [755] {378}
Montgomery	17,355	17,542	17,728	17,915	18,439 (3,688) [885] {443}	19,011 (3,802) [913] {456}	19,635 (3,927) [942] {471}
Tarrant	96,642	96,968	97,294	100,650	102,095 (20,419) [4,901] {2,450}	103,476 (20,695) [4,967] {2,483}	104,795 (20,959) [5,030] {2,515}
Travis	37,666	37,898	38,045	38,377	38,893 (7,779) [1,867] {933}	39,423 (7,885) [1,892] {946}	39,967 (7,993) [1,918] {959}
Williamson	12,787	12,958	13,130	13,301	13,812 (2,762) [663] {331}	14,397 (2,879) [691] {346}	15,067 (3,013) [723] {362}

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.