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

Date: 3/5/21

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 3/5/21 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.

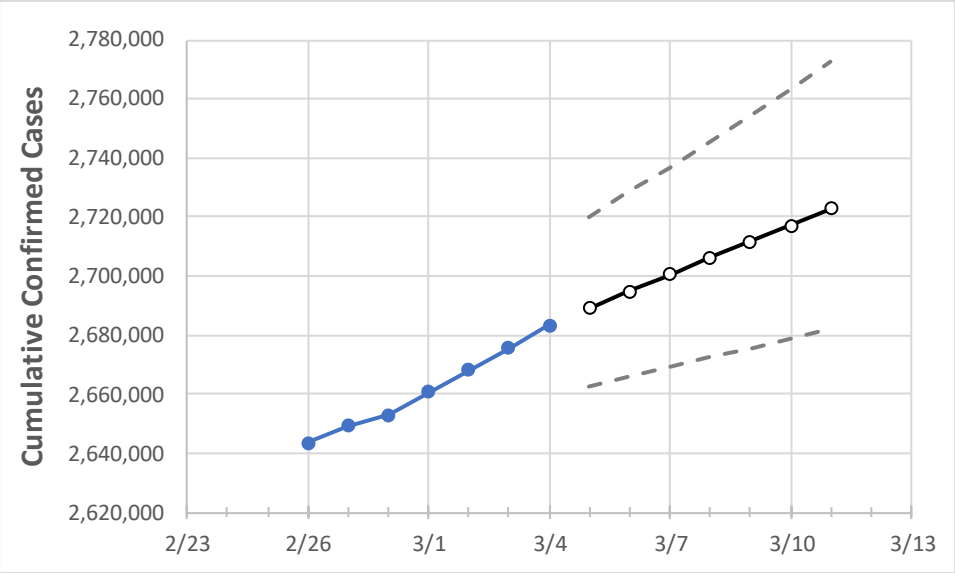
IEM's Modeling Lead

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:						
	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11
Texas	2,660,791	2,668,091	2,675,712	2,683,386	2,689,196	2,694,963	2,700,656	2,706,330	2,711,864	2,717,280	2,722,738

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:						
	3/1	3/2	3/3	3/4	3/5	3/6	3/7	3/8	3/9	3/10	3/11
Bexar	196,816	197,065	197,255	197,497	197,910	198,309	198,675	199,042	199,399	199,744	200,085
Brazoria	32,966	33,040	33,152	33,169	33,285	33,397	33,516	33,631	33,737	33,847	33,963
Brazos	21,046	21,172	21,243	21,360	21,432	21,505	21,579	21,648	21,721	21,793	21,867
Collin	83,404	83,508	83,612	83,716	83,854	83,985	84,107	84,229	84,352	84,466	84,571
Dallas	281,155	281,681	282,399	283,180	283,533	283,890	284,235	284,562	284,897	285,213	285,517
Denton	64,697	65,171	65,821	66,394	66,863	67,355	67,860	68,374	68,916	69,468	70,042
El Paso	123,979	124,162	124,438	124,812	125,056	125,295	125,528	125,754	125,972	126,203	126,411
Ellis	20,793	20,833	20,936	21,317	21,389	21,462	21,539	21,616	21,694	21,773	21,854
Fort Bend	57,721	58,219	58,663	58,975	59,171	59,374	59,581	59,784	59,982	60,187	60,387
Galveston	34,664	34,736	34,896	34,998	35,089	35,181	35,272	35,366	35,454	35,542	35,629
Harris	351,063	353,450	355,065	356,429	357,666	358,948	360,231	361,563	362,903	364,149	365,464
Hidalgo	77,312	77,702	78,165	78,468	78,874	79,277	79,681	80,100	80,495	80,897	81,307
Johnson	18,578	18,608	18,655	18,715	18,748	18,779	18,810	18,840	18,869	18,898	18,925
Lubbock	48,160	48,175	48,191	48,196	48,210	48,224	48,236	48,248	48,260	48,271	48,281
McLennan	25,096	25,132	25,192	25,237	25,290	25,342	25,392	25,443	25,492	25,541	25,589
Montgomery	45,528	45,635	45,872	46,058	46,206	46,350	46,494	46,640	46,779	46,921	47,062
Tarrant	242,638	243,067	243,725	244,231	244,676	245,127	245,568	246,003	246,431	246,839	247,253
Travis	75,901	76,088	76,274	76,365	76,500	76,632	76,763	76,891	77,014	77,141	77,270
Williamson	40,927	41,137	41,194	41,250	41,334	41,418	41,501	41,584	41,670	41,754	41,836

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:		
	3/1	3/2	3/3	3/4	3/6	3/8	3/10
Bexar	196,816	197,065	197,255	197,497	198,309 (39,662) [9,519] {4,759}	199,042 (39,808) [9,554] {4,777}	199,744 (39,949) [9,588] {4,794}
Brazoria	32,966	33,040	33,152	33,169	33,397 (6,679) [1,603] {802}	33,631 (6,726) [1,614] {807}	33,847 (6,769) [1,625] {812}
Brazos	21,046	21,172	21,243	21,360	21,505 (4,301) [1,032] {516}	21,648 (4,330) [1,039] {520}	21,793 (4,359) [1,046] {523}
Collin	83,404	83,508	83,612	83,716	83,985 (16,797) [4,031] {2,016}	84,229 (16,846) [4,043] {2,021}	84,466 (16,893) [4,054] {2,027}
Dallas	281,155	281,681	282,399	283,180	283,890 (56,778) [13,627] {6,813}	284,562 (56,912) [13,659] {6,829}	285,213 (57,043) [13,690] {6,845}
Denton	64,697	65,171	65,821	66,394	67,355 (13,471) [3,233] {1,617}	68,374 (13,675) [3,282] {1,641}	69,468 (13,894) [3,334] {1,667}
El Paso	123,979	124,162	124,438	124,812	125,295 (25,059) [6,014] {3,007}	125,754 (25,151) [6,036] {3,018}	126,203 (25,241) [6,058] {3,029}
Ellis	20,793	20,833	20,936	21,317	21,462 (4,292) [1,030] {515}	21,616 (4,323) [1,038] {519}	21,773 (4,355) [1,045] {523}
Fort Bend	57,721	58,219	58,663	58,975	59,374 (11,875) [2,850] {1,425}	59,784 (11,957) [2,870] {1,435}	60,187 (12,037) [2,889] {1,444}
Galveston	34,664	34,736	34,896	34,998	35,181 (7,036) [1,689] {844}	35,366 (7,073) [1,698] {849}	35,542 (7,108) [1,706] {853}
Harris	351,063	353,450	355,065	356,429	358,948 (71,790) [17,229] {8,615}	361,563 (72,313) [17,355] {8,678}	364,149 (72,830) [17,479] {8,740}
Hidalgo	77,312	77,702	78,165	78,468	79,277 (15,855) [3,805] {1,903}	80,100 (16,020) [3,845] {1,922}	80,897 (16,179) [3,883] {1,942}
Johnson	18,578	18,608	18,655	18,715	18,779 (3,756) [901] {451}	18,840 (3,768) [904] {452}	18,898 (3,780) [907] {454}
Lubbock	48,160	48,175	48,191	48,196	48,224 (9,645) [2,315] {1,157}	48,248 (9,650) [2,316] {1,158}	48,271 (9,654) [2,317] {1,158}
McLennan	25,096	25,132	25,192	25,237	25,342 (5,068) [1,216] {608}	25,443 (5,089) [1,221] {611}	25,541 (5,108) [1,226] {613}
Montgomery	45,528	45,635	45,872	46,058	46,350 (9,270) [2,225] {1,112}	46,640 (9,328) [2,239] {1,119}	46,921 (9,384) [2,252] {1,126}
Tarrant	242,638	243,067	243,725	244,231	245,127 (49,025) [11,766] {5,883}	246,003 (49,201) [11,808] {5,904}	246,839 (49,368) [11,848] {5,924}
Travis	75,901	76,088	76,274	76,365	76,632 (15,326) [3,678] {1,839}	76,891 (15,378) [3,691] {1,845}	77,141 (15,428) [3,703] {1,851}
Williamson	40,927	41,137	41,194	41,250	41,418 (8,284) [1,988] {994}	41,584 (8,317) [1,996] {998}	41,754 (8,351) [2,004] {1,002}

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.