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

Date: 11/19/21

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 11/19/21 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.

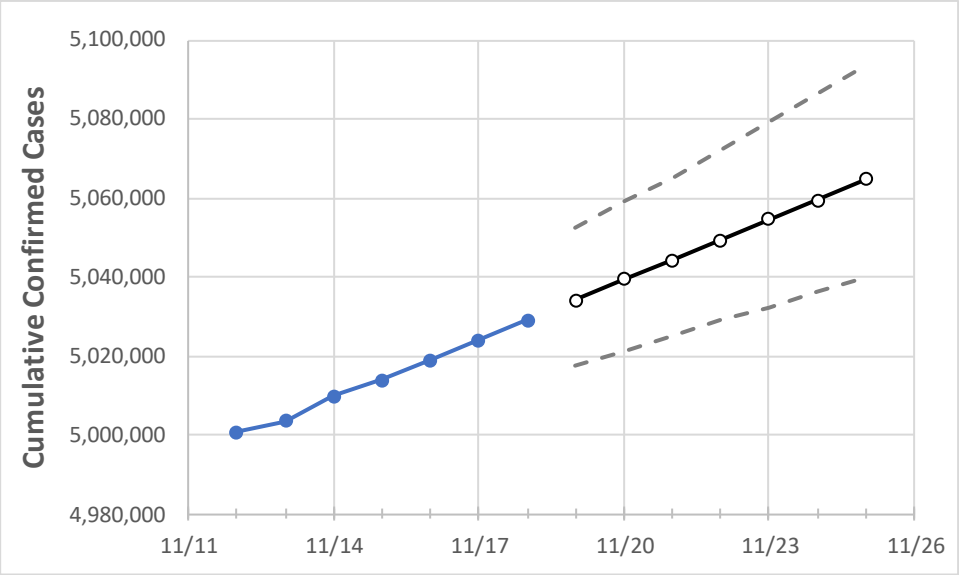
IEM's Modeling Lead

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.

California State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	11/15	11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23	11/24	11/25
California	5,013,920	5,018,987	5,023,913	5,028,939	5,034,147	5,039,387	5,044,298	5,049,331	5,054,554	5,059,414	5,064,842

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.

California Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	11/15	11/16	11/17	11/18	11/19	11/20	11/21	11/22	11/23	11/24	11/25
Alameda	123,736	123,814	123,918	123,953	124,057	124,152	124,253	124,351	124,451	124,558	124,644
Contra Costa	102,556	102,625	102,692	102,718	102,795	102,870	102,941	103,011	103,086	103,160	103,224
Fresno	154,401	154,586	154,752	154,879	155,076	155,295	155,482	155,684	155,894	156,093	156,306
Kern	154,185	154,583	154,896	155,118	155,394	155,658	155,920	156,188	156,455	156,711	156,967
Lake	6,933	6,938	6,944	6,949	6,955	6,961	6,967	6,973	6,979	6,985	6,990
Los Angeles	1,512,147	1,513,016	1,514,282	1,515,324	1,516,509	1,517,673	1,518,840	1,520,018	1,521,140	1,522,332	1,523,468
Marin	18,197	18,210	18,231	18,242	18,259	18,277	18,295	18,312	18,330	18,347	18,364
Monterey	51,957	51,998	52,024	52,161	52,203	52,242	52,280	52,327	52,366	52,409	52,457
Orange	330,798	330,981	331,322	331,522	331,776	332,026	332,275	332,530	332,781	333,031	333,278
Placer	41,428	41,494	41,543	41,605	41,657	41,721	41,767	41,824	41,880	41,935	41,985
Riverside	381,999	382,327	382,655	382,750	383,087	383,436	383,756	384,085	384,411	384,772	385,072
Sacramento	165,935	166,100	166,267	166,341	166,507	166,691	166,842	167,008	167,176	167,360	167,512
San Bernardino	368,916	369,138	369,557	369,796	370,178	370,538	370,918	371,250	371,614	372,034	372,385
San Diego	400,285	400,689	401,279	401,843	402,362	402,877	403,399	403,911	404,438	404,970	405,486
San Francisco	56,135	56,176	56,230	56,253	56,323	56,392	56,457	56,517	56,591	56,653	56,727
San Joaquin	106,153	106,203	106,330	106,396	106,500	106,601	106,697	106,795	106,895	106,995	107,091
San Luis Obispo	30,958	30,992	31,020	31,042	31,071	31,098	31,125	31,152	31,178	31,207	31,231
San Mateo	55,652	55,676	55,734	55,790	55,842	55,892	55,944	55,992	56,046	56,099	56,151
Santa Barbara	46,586	46,639	46,707	46,717	46,766	46,813	46,859	46,905	46,953	46,998	47,044
Santa Clara	149,740	149,879	150,053	150,095	150,244	150,397	150,547	150,707	150,868	151,023	151,188
Santa Cruz	21,723	21,777	21,793	21,799	21,830	21,861	21,891	21,923	21,954	21,987	22,023
Solano	47,109	47,132	47,172	47,207	47,243	47,279	47,315	47,351	47,387	47,425	47,459
Sonoma	42,561	42,596	42,633	42,637	42,682	42,726	42,765	42,809	42,849	42,890	42,930
Ventura	103,060	103,186	103,267	103,295	103,372	103,438	103,514	103,593	103,664	103,740	103,811

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.*

California Medical Demand by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	11/15	11/16	11/17	11/18	11/20	11/22	11/24
Alameda	123,736	123,814	123,918	123,953	124,152 (24,830) [5,959] {2,980}	124,351 (24,870) [5,969] {2,984}	124,558 (24,912) [5,979] {2,989}
Contra Costa	102,556	102,625	102,692	102,718	102,870 (20,574) [4,938] {2,469}	103,011 (20,602) [4,945] {2,472}	103,160 (20,632) [4,952] {2,476}
Fresno	154,401	154,586	154,752	154,879	155,295 (31,059) [7,454] {3,727}	155,684 (31,137) [7,473] {3,736}	156,093 (31,219) [7,492] {3,746}
Kern	154,185	154,583	154,896	155,118	155,658 (31,132) [7,472] {3,736}	156,188 (31,238) [7,497] {3,749}	156,711 (31,342) [7,522] {3,761}
Lake	6,933	6,938	6,944	6,949	6,961 (1,392) [334] {167}	6,973 (1,395) [335] {167}	6,985 (1,397) [335] {168}
Los Angeles	1,512,147	1,513,016	1,514,282	1,515,324	1,517,673 (303,535) [72,848] {36,424}	1,520,018 (304,004) [72,961] {36,480}	1,522,332 (304,466) [73,072] {36,536}
Marin	18,197	18,210	18,231	18,242	18,277 (3,655) [877] {439}	18,312 (3,662) [879] {439}	18,347 (3,669) [881] {440}
Monterey	51,957	51,998	52,024	52,161	52,242 (10,448) [2,508] {1,254}	52,327 (10,465) [2,512] {1,256}	52,409 (10,482) [2,516] {1,258}
Orange	330,798	330,981	331,322	331,522	332,026 (66,405) [15,937] {7,969}	332,530 (66,506) [15,961] {7,981}	333,031 (66,606) [15,985] {7,993}
Placer	41,428	41,494	41,543	41,605	41,721 (8,344) [2,003] {1,001}	41,824 (8,365) [2,008] {1,004}	41,935 (8,387) [2,013] {1,006}
Riverside	381,999	382,327	382,655	382,750	383,436 (76,687) [18,405] {9,202}	384,085 (76,817) [18,436] {9,218}	384,772 (76,954) [18,469] {9,235}
Sacramento	165,935	166,100	166,267	166,341	166,691 (33,338) [8,001] {4,001}	167,008 (33,402) [8,016] {4,008}	167,360 (33,472) [8,033] {4,017}
San Bernardino	368,916	369,138	369,557	369,796	370,538 (74,108) [17,786] {8,893}	371,250 (74,250) [17,820] {8,910}	372,034 (74,407) [17,858] {8,929}
San Diego	400,285	400,689	401,279	401,843	402,877 (80,575) [19,338] {9,669}	403,911 (80,782) [19,388] {9,694}	404,970 (80,994) [19,439] {9,719}
San Francisco	56,135	56,176	56,230	56,253	56,392 (11,278) [2,707] {1,353}	56,517 (11,303) [2,713] {1,356}	56,653 (11,331) [2,719] {1,360}
San Joaquin	106,153	106,203	106,330	106,396	106,601 (21,320) [5,117] {2,558}	106,795 (21,359) [5,126] {2,563}	106,995 (21,399) [5,136] {2,568}
San Luis Obispo	30,958	30,992	31,020	31,042	31,098 (6,220) [1,493] {746}	31,152 (6,230) [1,495] {748}	31,207 (6,241) [1,498] {749}
San Mateo	55,652	55,676	55,734	55,790	55,892 (11,178) [2,683] {1,341}	55,992 (11,198) [2,688] {1,344}	56,099 (11,220) [2,693] {1,346}
Santa Barbara	46,586	46,639	46,707	46,717	46,813 (9,363) [2,247] {1,124}	46,905 (9,381) [2,251] {1,126}	46,998 (9,400) [2,256] {1,128}
Santa Clara	149,740	149,879	150,053	150,095	150,397 (30,079) [7,219] {3,610}	150,707 (30,141) [7,234] {3,617}	151,023 (30,205) [7,249] {3,625}
Santa Cruz	21,723	21,777	21,793	21,799	21,861 (4,372) [1,049] {525}	21,923 (4,385) [1,052] {526}	21,987 (4,397) [1,055] {528}
Solano	47,109	47,132	47,172	47,207	47,279 (9,456) [2,269] {1,135}	47,351 (9,470) [2,273] {1,136}	47,425 (9,485) [2,276] {1,138}
Sonoma	42,561	42,596	42,633	42,637	42,726 (8,545) [2,051] {1,025}	42,809 (8,562) [2,055] {1,027}	42,890 (8,578) [2,059] {1,029}
Ventura	103,060	103,186	103,267	103,295	103,438 (20,688) [4,965] {2,483}	103,593 (20,719) [4,972] {2,486}	103,740 (20,748) [4,980] {2,490}

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.