IEM's AI Modeling: Short-term COVID-19 Projections
Date: 6/28/21

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 6/28/21 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
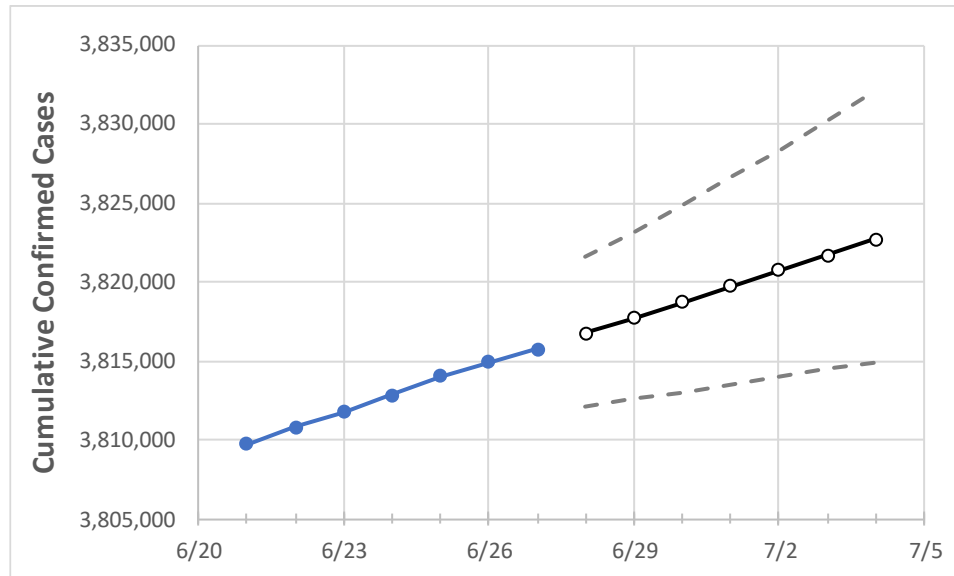
	Actual Confirmed Cases On:				Projected Cases For:						
	6/24	6/25	6/26	6/27	6/28	6/29	6/30	7/1	7/2	7/3	7/4
California	3,812,825	3,814,010	3,814,890	3,815,751	3,816,742	3,817,722	3,818,731	3,819,720	3,820,715	3,821,717	3,822,717

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:						
	6/24	6/25	6/26	6/27	6/28	6/29	6/30	7/1	7/2	7/3	7/4
Alameda	89,891	89,937	90,090	90,103	90,159	90,217	90,276	90,336	90,398	90,459	90,528
Contra Costa	70,882	70,914	70,945	71,048	71,101	71,157	71,211	71,269	71,325	71,380	71,438
Fresno	103,020	103,061	103,073	103,091	103,116	103,141	103,167	103,193	103,220	103,248	103,276
Kern	110,898	110,948	110,948	110,948	110,972	110,996	111,021	111,047	111,071	111,096	111,121
Lake	3,566	3,571	3,574	3,576	3,577	3,579	3,580	3,581	3,583	3,584	3,585
Los Angeles	1,248,415	1,248,737	1,249,065	1,249,304	1,249,555	1,249,807	1,250,067	1,250,322	1,250,589	1,250,857	1,251,141
Marin	14,212	14,215	14,218	14,224	14,227	14,231	14,234	14,237	14,240	14,244	14,247
Monterey	43,858	43,859	43,860	43,860	43,864	43,867	43,870	43,873	43,877	43,880	43,883
Orange	273,170	273,225	273,225	273,225	273,270	273,316	273,362	273,409	273,455	273,501	273,549
Placer	23,656	23,673	23,688	23,702	23,725	23,746	23,769	23,791	23,813	23,835	23,858
Riverside	301,799	301,799	301,799	301,799	301,821	301,842	301,863	301,884	301,903	301,922	301,940
Sacramento	108,013	108,085	108,132	108,179	108,245	108,312	108,380	108,446	108,516	108,583	108,653
San Bernardino	299,425	299,480	299,502	299,604	299,652	299,700	299,750	299,799	299,849	299,900	299,953
San Diego	282,052	282,156	282,262	282,358	282,441	282,526	282,616	282,710	282,800	282,895	282,988
San Francisco	37,304	37,320	37,338	37,348	37,360	37,373	37,385	37,397	37,410	37,423	37,435
San Joaquin	74,808	74,808	74,808	74,808	74,826	74,843	74,860	74,877	74,892	74,908	74,922
San Luis Obispo	21,448	21,448	21,448	21,448	21,450	21,451	21,453	21,454	21,455	21,457	21,458
San Mateo	42,756	42,814	42,849	42,898	42,937	42,979	43,023	43,068	43,120	43,173	43,231
Santa Barbara	34,631	34,637	34,642	34,642	34,647	34,653	34,658	34,663	34,669	34,674	34,679
Santa Clara	120,233	120,274	120,272	120,321	120,356	120,389	120,424	120,458	120,494	120,528	120,564
Santa Cruz	16,262	16,262	16,262	16,262	16,268	16,274	16,280	16,286	16,293	16,299	16,306
Solano	33,822	33,846	33,846	33,846	33,870	33,895	33,920	33,945	33,972	33,998	34,026
Sonoma	31,026	31,059	31,103	31,103	31,135	31,168	31,202	31,236	31,270	31,305	31,340
Ventura	81,739	81,750	81,750	81,750	81,767	81,784	81,801	81,820	81,837	81,855	81,873

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: | | |
	6/24	6/25	6/26	6/27	6/29	7/1	7/3
Alameda	89,891	89,937	90,090	90,103	90,217 (18,043) [4,330] {2,165}	90,336 (18,067) [4,336] {2,168}	90,459 (18,092) [4,342] {2,171}
Contra Costa	70,882	70,914	70,945	71,048	71,157 (14,231) [3,416] {1,708}	71,269 (14,254) [3,421] {1,710}	71,380 (14,276) [3,426] {1,713}
Fresno	103,020	103,061	103,073	103,091	103,141 (20,628) [4,951] {2,475}	103,193 (20,639) [4,953] {2,477}	103,248 (20,650) [4,956] {2,478}
Kern	110,898	110,948	110,948	110,948	110,996 (22,199) [5,328] {2,664}	111,047 (22,209) [5,330] {2,665}	111,096 (22,219) [5,333] {2,666}
Lake	3,566	3,571	3,574	3,576	3,579 (716) [172] {86}	3,581 (716) [172] {86}	3,584 (717) [172] {86}
Los Angeles	1,248,415	1,248,737	1,249,065	1,249,304	1,249,807 (249,961) [59,991] {29,995}	1,250,322 (250,064) [60,015] {30,008}	1,250,857 (250,171) [60,041] {30,021}
Marin	14,212	14,215	14,218	14,224	14,231 (2,846) [683] {342}	14,237 (2,847) [683] {342}	14,244 (2,849) [684] {342}
Monterey	43,858	43,859	43,860	43,860	43,867 (8,773) [2,106] {1,053}	43,873 (8,775) [2,106] {1,053}	43,880 (8,776) [2,106] {1,053}
Orange	273,170	273,225	273,225	273,225	273,316 (54,663) [13,119] {6,560}	273,409 (54,682) [13,124] {6,562}	273,501 (54,700) [13,128] {6,564}
Placer	23,656	23,673	23,688	23,702	23,746 (4,749) [1,140] {570}	23,791 (4,758) [1,142] {571}	23,835 (4,767) [1,144] {572}
Riverside	301,799	301,799	301,799	301,799	301,842 (60,368) [14,488] {7,244}	301,884 (60,377) [14,490] {7,245}	301,922 (60,384) [14,492] {7,246}
Sacramento	108,013	108,085	108,132	108,179	108,312 (21,662) [5,199] {2,599}	108,446 (21,689) [5,205] {2,603}	108,583 (21,717) [5,212] {2,606}
San Bernardino	299,425	299,480	299,502	299,604	299,700 (59,940) [14,386] {7,193}	299,799 (59,960) [14,390] {7,195}	299,900 (59,980) [14,395] {7,198}
San Diego	282,052	282,156	282,262	282,358	282,526 (56,505) [13,561] {6,781}	282,710 (56,542) [13,570] {6,785}	282,895 (56,579) [13,579] {6,789}
San Francisco	37,304	37,320	37,338	37,348	37,373 (7,475) [1,794] {897}	37,397 (7,479) [1,795] {898}	37,423 (7,485) [1,796] {898}
San Joaquin	74,808	74,808	74,808	74,808	74,843 (14,969) [3,592] {1,796}	74,877 (14,975) [3,594] {1,797}	74,908 (14,982) [3,596] {1,798}
San Luis Obispo	21,448	21,448	21,448	21,448	21,451 (4,290) [1,030] {515}	21,454 (4,291) [1,030] {515}	21,457 (4,291) [1,030] {515}
San Mateo	42,756	42,814	42,849	42,898	42,979 (8,596) [2,063] {1,032}	43,068 (8,614) [2,067] {1,034}	43,173 (8,635) [2,072] {1,036}
Santa Barbara	34,631	34,637	34,642	34,642	34,653 (6,931) [1,663] {832}	34,663 (6,933) [1,664] {832}	34,674 (6,935) [1,664] {832}
Santa Clara	120,233	120,274	120,272	120,321	120,389 (24,078) [5,779] {2,889}	120,458 (24,092) [5,782] {2,891}	120,528 (24,106) [5,785] {2,893}
Santa Cruz	16,262	16,262	16,262	16,262	16,274 (3,255) [781] {391}	16,286 (3,257) [782] {391}	16,299 (3,260) [782] {391}
Solano	33,822	33,846	33,846	33,846	33,895 (6,779) [1,627] {813}	33,945 (6,789) [1,629] {815}	33,998 (6,800) [1,632] {816}
Sonoma	31,026	31,059	31,103	31,103	31,168 (6,234) [1,496] {748}	31,236 (6,247) [1,499] {750}	31,305 (6,261) [1,503] {751}
Ventura	81,739	81,750	81,750	81,750	81,784 (16,357) [3,926] {1,963}	81,820 (16,364) [3,927] {1,964}	81,855 (16,371) [3,929] {1,965}

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.