IEM's AI Modeling: Short-term COVID-19 Projections
Date: 8/20/21

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 8/20/21 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
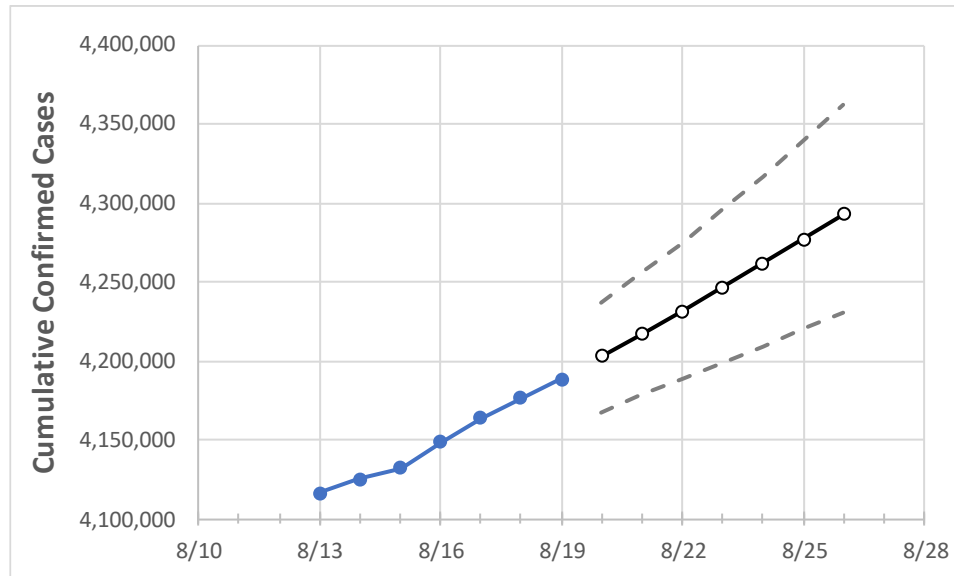
	Actual Confirmed Cases On:				Projected Cases For:						
	8/16	8/17	8/18	8/19	8/20	8/21	8/22	8/23	8/24	8/25	8/26
California	4,148,367	4,163,848	4,176,356	4,188,640	4,202,773	4,217,175	4,231,684	4,246,442	4,261,546	4,277,099	4,293,041

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:						
	8/16	8/17	8/18	8/19	8/20	8/21	8/22	8/23	8/24	8/25	8/26
Alameda	102,101	102,751	103,075	103,503	103,915	104,333	104,752	105,183	105,633	106,085	106,526
Contra Costa	82,440	82,850	82,850	82,850	83,210	83,582	83,949	84,314	84,696	85,072	85,461
Fresno	109,382	109,623	110,263	110,523	110,957	111,410	111,887	112,380	112,896	113,429	114,001
Kern	118,025	118,360	118,794	119,277	119,710	120,154	120,608	121,092	121,588	122,098	122,633
Lake	4,886	4,898	4,930	4,957	4,989	5,022	5,055	5,086	5,118	5,150	5,183
Los Angeles	1,353,071	1,356,249	1,359,897	1,362,848	1,366,270	1,369,759	1,373,238	1,376,706	1,380,179	1,383,725	1,387,236
Marin	15,683	15,717	15,778	15,778	15,833	15,888	15,943	15,999	16,056	16,114	16,175
Monterey	45,369	45,528	45,620	45,620	45,706	45,797	45,891	45,989	46,092	46,200	46,310
Orange	295,123	295,885	297,163	297,785	298,673	299,587	300,483	301,423	302,355	303,293	304,268
Placer	27,220	27,691	27,850	28,008	28,190	28,387	28,592	28,813	29,023	29,248	29,495
Riverside	320,777	322,251	323,578	323,578	324,600	325,652	326,745	327,944	329,174	330,390	331,677
Sacramento	123,924	124,604	125,151	126,002	126,659	127,351	128,059	128,773	129,517	130,275	131,053
San Bernardino	317,200	318,838	319,997	321,155	322,181	323,240	324,431	325,671	326,982	328,354	329,790
San Diego	315,348	317,058	318,152	319,582	321,027	322,483	324,005	325,538	327,125	328,750	330,371
San Francisco	44,531	44,681	44,820	44,957	45,144	45,326	45,502	45,688	45,865	46,035	46,203
San Joaquin	80,832	81,087	81,300	81,601	81,902	82,208	82,539	82,870	83,209	83,575	83,935
San Luis Obispo	23,404	23,737	23,737	23,737	23,896	24,070	24,251	24,443	24,640	24,858	25,099
San Mateo	46,897	47,024	47,127	47,255	47,389	47,522	47,654	47,785	47,918	48,051	48,184
Santa Barbara	37,454	37,566	37,700	37,700	37,850	38,003	38,162	38,331	38,505	38,685	38,871
Santa Clara	128,454	128,862	129,066	129,630	130,030	130,431	130,847	131,273	131,707	132,153	132,612
Santa Cruz	17,497	17,513	17,528	17,663	17,730	17,801	17,878	17,954	18,036	18,128	18,219
Solano	37,914	38,104	38,294	38,294	38,436	38,583	38,733	38,883	39,039	39,195	39,360
Sonoma	34,839	34,992	35,093	35,210	35,332	35,456	35,585	35,712	35,837	35,966	36,091
Ventura	86,977	87,202	87,601	87,835	88,096	88,370	88,657	88,947	89,241	89,547	89,877

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:		
	8/16	8/17	8/18	8/19	8/21	8/23	8/25
Alameda	102,101	102,751	103,075	103,503	104,333 (20,867) [5,008] {2,504}	105,183 (21,037) [5,049] {2,524}	106,085 (21,217) [5,092] {2,546}
Contra Costa	82,440	82,850	82,850	82,850	83,582 (16,716) [4,012] {2,006}	84,314 (16,863) [4,047] {2,024}	85,072 (17,014) [4,083] {2,042}
Fresno	109,382	109,623	110,263	110,523	111,410 (22,282) [5,348] {2,674}	112,380 (22,476) [5,394] {2,697}	113,429 (22,686) [5,445] {2,722}
Kern	118,025	118,360	118,794	119,277	120,154 (24,031) [5,767] {2,884}	121,092 (24,218) [5,812] {2,906}	122,098 (24,420) [5,861] {2,930}
Lake	4,886	4,898	4,930	4,957	5,022 (1,004) [241] {121}	5,086 (1,017) [244] {122}	5,150 (1,030) [247] {124}
Los Angeles	1,353,071	1,356,249	1,359,897	1,362,848	1,369,759 (273,952) [65,748] {32,874}	1,376,706 (275,341) [66,082] {33,041}	1,383,725 (276,745) [66,419] {33,209}
Marin	15,683	15,717	15,778	15,778	15,888 (3,178) [763] {381}	15,999 (3,200) [768] {384}	16,114 (3,223) [773] {387}
Monterey	45,369	45,528	45,620	45,620	45,797 (9,159) [2,198] {1,099}	45,989 (9,198) [2,207] {1,104}	46,200 (9,240) [2,218] {1,109}
Orange	295,123	295,885	297,163	297,785	299,587 (59,917) [14,380] {7,190}	301,423 (60,285) [14,468] {7,234}	303,293 (60,659) [14,558] {7,279}
Placer	27,220	27,691	27,850	28,008	28,387 (5,677) [1,363] {681}	28,813 (5,763) [1,383] {692}	29,248 (5,850) [1,404] {702}
Riverside	320,777	322,251	323,578	323,578	325,652 (65,130) [15,631] {7,816}	327,944 (65,589) [15,741] {7,871}	330,390 (66,078) [15,859] {7,929}
Sacramento	123,924	124,604	125,151	126,002	127,351 (25,470) [6,113] {3,056}	128,773 (25,755) [6,181] {3,091}	130,275 (26,055) [6,253] {3,127}
San Bernardino	317,200	318,838	319,997	321,155	323,240 (64,648) [15,516] {7,758}	325,671 (65,134) [15,632] {7,816}	328,354 (65,671) [15,761] {7,880}
San Diego	315,348	317,058	318,152	319,582	322,483 (64,497) [15,479] {7,740}	325,538 (65,108) [15,626] {7,813}	328,750 (65,750) [15,780] {7,890}
San Francisco	44,531	44,681	44,820	44,957	45,326 (9,065) [2,176] {1,088}	45,688 (9,138) [2,193] {1,097}	46,035 (9,207) [2,210] {1,105}
San Joaquin	80,832	81,087	81,300	81,601	82,208 (16,442) [3,946] {1,973}	82,870 (16,574) [3,978] {1,989}	83,575 (16,715) [4,012] {2,006}
San Luis Obispo	23,404	23,737	23,737	23,737	24,070 (4,814) [1,155] {578}	24,443 (4,889) [1,173] {587}	24,858 (4,972) [1,193] {597}
San Mateo	46,897	47,024	47,127	47,255	47,522 (9,504) [2,281] {1,141}	47,785 (9,557) [2,294] {1,147}	48,051 (9,610) [2,306] {1,153}
Santa Barbara	37,454	37,566	37,700	37,700	38,003 (7,601) [1,824] {912}	38,331 (7,666) [1,840] {920}	38,685 (7,737) [1,857] {928}
Santa Clara	128,454	128,862	129,066	129,630	130,431 (26,086) [6,261] {3,130}	131,273 (26,255) [6,301] {3,151}	132,153 (26,431) [6,343] {3,172}
Santa Cruz	17,497	17,513	17,528	17,663	17,801 (3,560) [854] {427}	17,954 (3,591) [862] {431}	18,128 (3,626) [870] {435}
Solano	37,914	38,104	38,294	38,294	38,583 (7,717) [1,852] {926}	38,883 (7,777) [1,866] {933}	39,195 (7,839) [1,881] {941}
Sonoma	34,839	34,992	35,093	35,210	35,456 (7,091) [1,702] {851}	35,712 (7,142) [1,714] {857}	35,966 (7,193) [1,726] {863}
Ventura	86,977	87,202	87,601	87,835	88,370 (17,674) [4,242] {2,121}	88,947 (17,789) [4,269] {2,135}	89,547 (17,909) [4,298] {2,149}

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.