

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 11/30/20**

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 11/30/20 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.

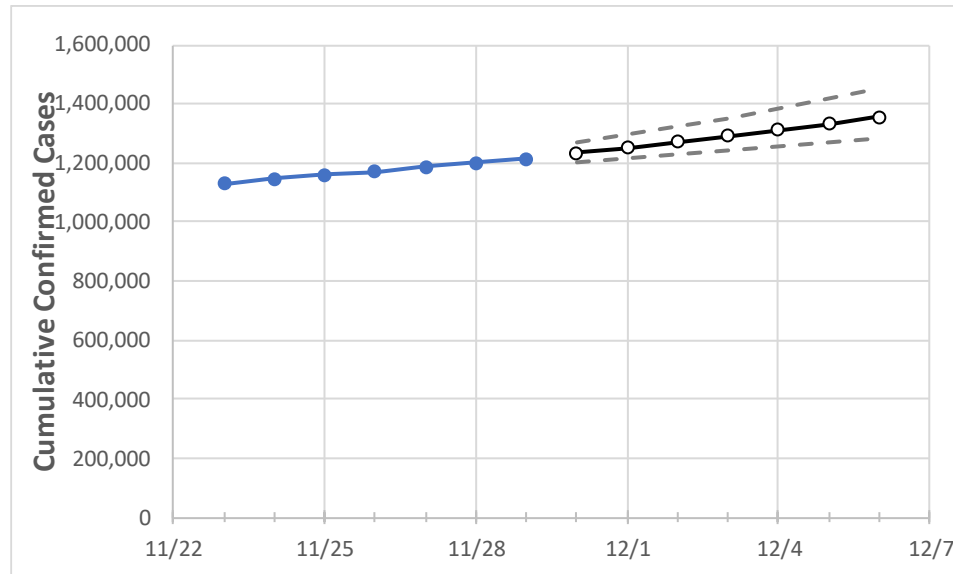
IEM's Modeling Lead

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.

California State Projections



	Actual Confirmed Cases On:					Projected Cases For:					
	11/26	11/27	11/28	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6
California	1,171,802	1,185,576	1,200,624	1,215,455	1,233,100	1,251,479	1,270,622	1,290,559	1,311,320	1,332,940	1,355,451

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.

California Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	11/26	11/27	11/28	11/29	11/30	12/1	12/2	12/3	12/4	12/5	12/6
Alameda	28,378	28,857	29,116	29,476	29,752	30,037	30,333	30,640	30,957	31,286	31,627
Contra Costa	23,381	23,571	23,733	23,895	24,105	24,318	24,535	24,755	24,980	25,208	25,440
Fresno	37,349	37,724	37,994	38,288	38,659	39,042	39,435	39,839	40,255	40,683	41,124
Kern	39,990	40,337	40,632	41,328	41,812	42,327	42,874	43,455	44,073	44,729	45,426
Los Angeles	383,275	387,793	390,891	395,843	400,957	406,271	411,793	417,531	423,494	429,688	436,124
Marin	7,628	7,666	7,704	7,755	7,786	7,819	7,853	7,888	7,924	7,962	8,001
Monterey	14,695	14,750	14,753	15,328	15,380	15,431	15,482	15,533	15,583	15,633	15,682
Orange	74,124	75,095	76,761	77,819	79,244	80,777	82,427	84,202	86,112	88,166	90,376
Placer	6,289	6,354	6,426	6,497	6,578	6,660	6,744	6,830	6,917	7,006	7,097
Riverside	85,077	85,774	85,769	86,854	88,098	89,408	90,789	92,243	93,775	95,389	97,088
Sacramento	35,739	35,854	36,579	36,905	37,380	37,866	38,362	38,870	39,390	39,921	40,465
San Bernardino	88,469	90,222	92,164	93,019	93,766	94,516	95,267	96,021	96,777	97,536	98,297
San Diego	75,307	76,359	80,018	81,084	81,879	82,694	83,530	84,386	85,264	86,164	87,086
San Francisco	15,053	15,156	15,377	15,450	15,588	15,729	15,873	16,020	16,171	16,325	16,483
San Joaquin	25,675	25,738	25,741	25,742	25,782	25,821	25,859	25,896	25,931	25,965	25,998
San Luis Obispo	5,956	5,964	6,129	6,129	6,174	6,219	6,265	6,310	6,355	6,400	6,445
San Mateo	13,711	13,715	14,148	14,148	14,194	14,238	14,281	14,323	14,364	14,404	14,442
Santa Barbara	11,205	11,277	11,340	11,481	11,561	11,643	11,730	11,819	11,913	12,010	12,112
Santa Clara	32,454	32,985	33,732	34,292	34,872	35,480	36,118	36,786	37,486	38,220	38,989
Santa Cruz	4,202	4,269	4,358	4,426	4,538	4,658	4,788	4,928	5,078	5,241	5,416
Solano	10,039	10,041	10,044	10,252	10,273	10,293	10,313	10,332	10,350	10,368	10,385
Sonoma	11,846	11,922	12,049	12,198	12,282	12,368	12,456	12,546	12,638	12,733	12,829
Ventura	18,914	19,058	19,379	19,510	19,757	20,012	20,276	20,549	20,832	21,124	21,426

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:											
	11/26	11/27	11/28	11/29	12/1				12/3				12/5			
Alameda	28,378	28,857	29,116	29,476	30,037	(6,007)	[1,442]	{721}	30,640	(6,128)	[1,471]	{735}	31,286	(6,257)	[1,502]	{751}
Contra Costa	23,381	23,571	23,733	23,895	24,318	(4,864)	[1,167]	{584}	24,755	(4,951)	[1,188]	{594}	25,208	(5,042)	[1,210]	{605}
Fresno	37,349	37,724	37,994	38,288	39,042	(7,808)	[1,874]	{937}	39,839	(7,968)	[1,912]	{956}	40,683	(8,137)	[1,953]	{976}
Kern	39,990	40,337	40,632	41,328	42,327	(8,465)	[2,032]	{1,016}	43,455	(8,691)	[2,086]	{1,043}	44,729	(8,946)	[2,147]	{1,073}
Los Angeles	383,275	387,793	390,891	395,843	406,271	(81,254)	[19,501]	{9,751}	417,531	(83,506)	[20,042]	{10,021}	429,688	(85,938)	[20,625]	{10,313}
Marin	7,628	7,666	7,704	7,755	7,819	(1,564)	[375]	{188}	7,888	(1,578)	[379]	{189}	7,962	(1,592)	[382]	{191}
Monterey	14,695	14,750	14,753	15,328	15,431	(3,086)	[741]	{370}	15,533	(3,107)	[746]	{373}	15,633	(3,127)	[750]	{375}
Orange	74,124	75,095	76,761	77,819	80,777	(16,155)	[3,877]	{1,939}	84,202	(16,840)	[4,042]	{2,021}	88,166	(17,633)	[4,232]	{2,116}
Placer	6,289	6,354	6,426	6,497	6,660	(1,332)	[320]	{160}	6,830	(1,366)	[328]	{164}	7,006	(1,401)	[336]	{168}
Riverside	85,077	85,774	85,769	86,854	89,408	(17,882)	[4,292]	{2,146}	92,243	(18,449)	[4,428]	{2,214}	95,389	(19,078)	[4,579]	{2,289}
Sacramento	35,739	35,854	36,579	36,905	37,866	(7,573)	[1,818]	{909}	38,870	(7,774)	[1,866]	{933}	39,921	(7,984)	[1,916]	{958}
San Bernardino	88,469	90,222	92,164	93,019	94,516	(18,903)	[4,537]	{2,268}	96,021	(19,204)	[4,609]	{2,305}	97,536	(19,507)	[4,682]	{2,341}
San Diego	75,307	76,359	80,018	81,084	82,694	(16,539)	[3,969]	{1,985}	84,386	(16,877)	[4,051]	{2,025}	86,164	(17,233)	[4,136]	{2,068}
San Francisco	15,053	15,156	15,377	15,450	15,729	(3,146)	[755]	{377}	16,020	(3,204)	[769]	{384}	16,325	(3,265)	[784]	{392}
San Joaquin	25,675	25,738	25,741	25,742	25,821	(5,164)	[1,239]	{620}	25,896	(5,179)	[1,243]	{621}	25,965	(5,193)	[1,246]	{623}
San Luis Obispo	5,956	5,964	6,129	6,129	6,219	(1,244)	[299]	{149}	6,310	(1,262)	[303]	{151}	6,400	(1,280)	[307]	{154}
San Mateo	13,711	13,715	14,148	14,148	14,238	(2,848)	[683]	{342}	14,323	(2,865)	[688]	{344}	14,404	(2,881)	[691]	{346}
Santa Barbara	11,205	11,277	11,340	11,481	11,643	(2,329)	[559]	{279}	11,819	(2,364)	[567]	{284}	12,010	(2,402)	[576]	{288}
Santa Clara	32,454	32,985	33,732	34,292	35,480	(7,096)	[1,703]	{852}	36,786	(7,357)	[1,766]	{883}	38,220	(7,644)	[1,835]	{917}
Santa Cruz	4,202	4,269	4,358	4,426	4,658	(932)	[224]	{112}	4,928	(986)	[237]	{118}	5,241	(1,048)	[252]	{126}
Solano	10,039	10,041	10,044	10,252	10,293	(2,059)	[494]	{247}	10,332	(2,066)	[496]	{248}	10,368	(2,074)	[498]	{249}
Sonoma	11,846	11,922	12,049	12,198	12,368	(2,474)	[594]	{297}	12,546	(2,509)	[602]	{301}	12,733	(2,547)	[611]	{306}
Ventura	18,914	19,058	19,379	19,510	20,012	(4,002)	[961]	{480}	20,549	(4,110)	[986]	{493}	21,124	(4,225)	[1,014]	{507}

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.