

**IEM's AI Modeling: Short-term COVID-19 Projections****Date: 11/10/20**

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 11/10/20 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.**

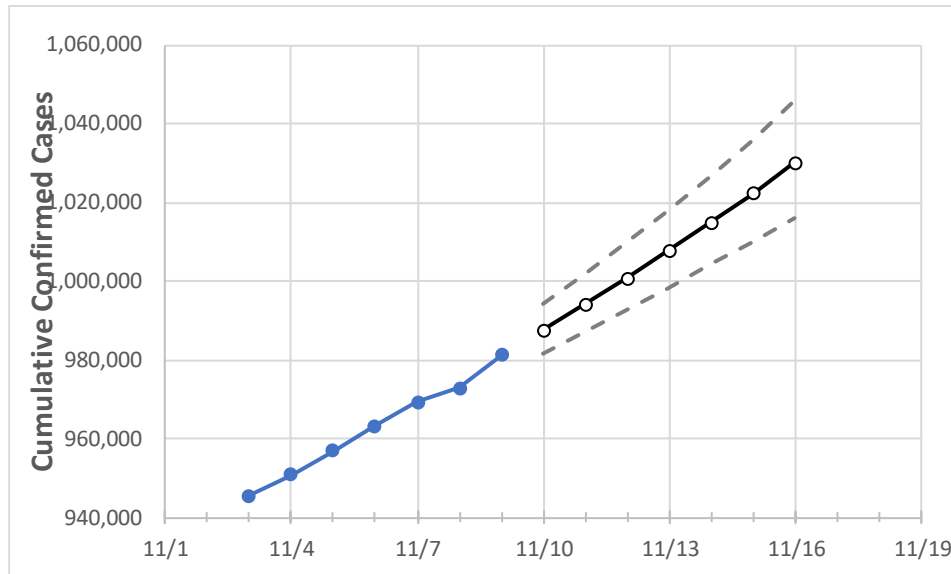
**IEM's Modeling Lead**

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:					
	11/6	11/7	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15	11/16
California	963,211	969,362	972,713	981,297	987,568	994,053	1,000,759	1,007,694	1,014,864	1,022,278	1,029,945

*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:						
	11/6	11/7	11/8	11/9	11/10	11/11	11/12	11/13	11/14	11/15	11/16
Alameda	24,418	24,664	24,833	25,001	25,124	25,250	25,379	25,512	25,647	25,787	25,929
Contra Costa	19,685	19,785	19,943	20,031	20,146	20,264	20,387	20,513	20,643	20,778	20,917
Fresno	32,056	32,278	32,497	32,619	32,750	32,884	33,019	33,157	33,297	33,439	33,582
Kern	34,973	35,063	35,229	35,394	35,530	35,672	35,822	35,978	36,142	36,314	36,493
Los Angeles	317,656	319,977	321,801	323,625	325,813	328,096	330,478	332,965	335,559	338,266	341,091
Marin	7,205	7,232	7,243	7,254	7,265	7,276	7,287	7,298	7,310	7,322	7,334
Monterey	11,998	12,136	12,224	12,312	12,383	12,457	12,534	12,613	12,694	12,778	12,865
Orange	61,421	61,743	62,255	62,563	62,890	63,228	63,577	63,937	64,308	64,691	65,086
Placer	4,692	4,719	4,745	4,853	4,906	4,963	5,023	5,087	5,155	5,227	5,303
Riverside	70,696	70,925	71,153	71,620	71,936	72,262	72,598	72,944	73,300	73,667	74,044
Sacramento	27,278	27,530	27,773	28,059	28,306	28,565	28,835	29,119	29,416	29,727	30,053
San Bernardino	67,777	68,242	68,721	68,865	69,310	69,767	70,237	70,719	71,214	71,723	72,244
San Diego	59,116	59,656	59,682	60,570	60,910	61,251	61,592	61,935	62,278	62,622	62,966
San Francisco	12,753	12,860	12,980	13,081	13,179	13,284	13,396	13,515	13,641	13,776	13,920
San Joaquin	22,556	22,635	22,635	22,635	22,695	22,759	22,827	22,899	22,975	23,057	23,143
San Luis Obispo	4,496	4,568	4,668	4,698	4,725	4,753	4,782	4,812	4,844	4,877	4,911
San Mateo	11,710	11,810	11,874	11,937	12,004	12,073	12,144	12,219	12,295	12,374	12,456
Santa Barbara	10,089	10,128	10,157	10,180	10,204	10,229	10,253	10,278	10,303	10,328	10,353
Santa Clara	25,883	26,137	26,490	26,747	26,971	27,205	27,449	27,703	27,969	28,245	28,534
Santa Cruz	3,031	3,074	3,130	3,134	3,157	3,182	3,207	3,233	3,260	3,288	3,316
Solano	8,132	8,210	8,288	8,366	8,455	8,547	8,644	8,744	8,850	8,959	9,074
Sonoma	10,170	10,248	10,336	10,424	10,501	10,579	10,658	10,739	10,821	10,904	10,988
Ventura	15,113	15,222	15,364	15,504	15,619	15,742	15,872	16,010	16,156	16,311	16,476

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:											
	11/6	11/7	11/8	11/9	11/11				11/13				11/15			
Alameda	24,418	24,664	24,833	25,001	25,250	(5,050)	[1,212]	{606}	25,512	(5,102)	[1,225]	{612}	25,787	(5,157)	[1,238]	{619}
Contra Costa	19,685	19,785	19,943	20,031	20,264	(4,053)	[973]	{486}	20,513	(4,103)	[985]	{492}	20,778	(4,156)	[997]	{499}
Fresno	32,056	32,278	32,497	32,619	32,884	(6,577)	[1,578]	{789}	33,157	(6,631)	[1,592]	{796}	33,439	(6,688)	[1,605]	{803}
Kern	34,973	35,063	35,229	35,394	35,672	(7,134)	[1,712]	{856}	35,978	(7,196)	[1,727]	{863}	36,314	(7,263)	[1,743]	{872}
Los Angeles	317,656	319,977	321,801	323,625	328,096	(65,619)	[15,749]	{7,874}	332,965	(66,593)	[15,982]	{7,991}	338,266	(67,653)	[16,237]	{8,118}
Marin	7,205	7,232	7,243	7,254	7,276	(1,455)	[349]	{175}	7,298	(1,460)	[350]	{175}	7,322	(1,464)	[351]	{176}
Monterey	11,998	12,136	12,224	12,312	12,457	(2,491)	[598]	{299}	12,613	(2,523)	[605]	{303}	12,778	(2,556)	[613]	{307}
Orange	61,421	61,743	62,255	62,563	63,228	(12,646)	[3,035]	{1,517}	63,937	(12,787)	[3,069]	{1,534}	64,691	(12,938)	[3,105]	{1,553}
Placer	4,692	4,719	4,745	4,853	4,963	(993)	[238]	{119}	5,087	(1,017)	[244]	{122}	5,227	(1,045)	[251]	{125}
Riverside	70,696	70,925	71,153	71,620	72,262	(14,452)	[3,469]	{1,734}	72,944	(14,589)	[3,501]	{1,751}	73,667	(14,733)	[3,536]	{1,768}
Sacramento	27,278	27,530	27,773	28,059	28,565	(5,713)	[1,371]	{686}	29,119	(5,824)	[1,398]	{699}	29,727	(5,945)	[1,427]	{713}
San Bernardino	67,777	68,242	68,721	68,865	69,767	(13,953)	[3,349]	{1,674}	70,719	(14,144)	[3,395]	{1,697}	71,723	(14,345)	[3,443]	{1,721}
San Diego	59,116	59,656	59,682	60,570	61,251	(12,250)	[2,940]	{1,470}	61,935	(12,387)	[2,973]	{1,486}	62,622	(12,524)	[3,006]	{1,503}
San Francisco	12,753	12,860	12,980	13,081	13,284	(2,657)	[638]	{319}	13,515	(2,703)	[649]	{324}	13,776	(2,755)	[661]	{331}
San Joaquin	22,556	22,635	22,635	22,635	22,759	(4,552)	[1,092]	{546}	22,899	(4,580)	[1,099]	{550}	23,057	(4,611)	[1,107]	{553}
San Luis Obispo	4,496	4,568	4,668	4,698	4,753	(951)	[228]	{114}	4,812	(962)	[231]	{115}	4,877	(975)	[234]	{117}
San Mateo	11,710	11,810	11,874	11,937	12,073	(2,415)	[580]	{290}	12,219	(2,444)	[586]	{293}	12,374	(2,475)	[594]	{297}
Santa Barbara	10,089	10,128	10,157	10,180	10,229	(2,046)	[491]	{245}	10,278	(2,056)	[493]	{247}	10,328	(2,066)	[496]	{248}
Santa Clara	25,883	26,137	26,490	26,747	27,205	(5,441)	[1,306]	{653}	27,703	(5,541)	[1,330]	{665}	28,245	(5,649)	[1,356]	{678}
Santa Cruz	3,031	3,074	3,130	3,134	3,182	(636)	[153]	{76}	3,233	(647)	[155]	{78}	3,288	(658)	[158]	{79}
Solano	8,132	8,210	8,288	8,366	8,547	(1,709)	[410]	{205}	8,744	(1,749)	[420]	{210}	8,959	(1,792)	[430]	{215}
Sonoma	10,170	10,248	10,336	10,424	10,579	(2,116)	[508]	{254}	10,739	(2,148)	[515]	{258}	10,904	(2,181)	[523]	{262}
Ventura	15,113	15,222	15,364	15,504	15,742	(3,148)	[756]	{378}	16,010	(3,202)	[768]	{384}	16,311	(3,262)	[783]	{391}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at [bryan.koon@iem.com](mailto:bryan.koon@iem.com) or 850-519-7966 or Stephanie Tennyson at [stephanie.tennyson@iem.com](mailto:stephanie.tennyson@iem.com) or 202-309-4257.