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

Date: 10/29/20

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 10/29/20 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.

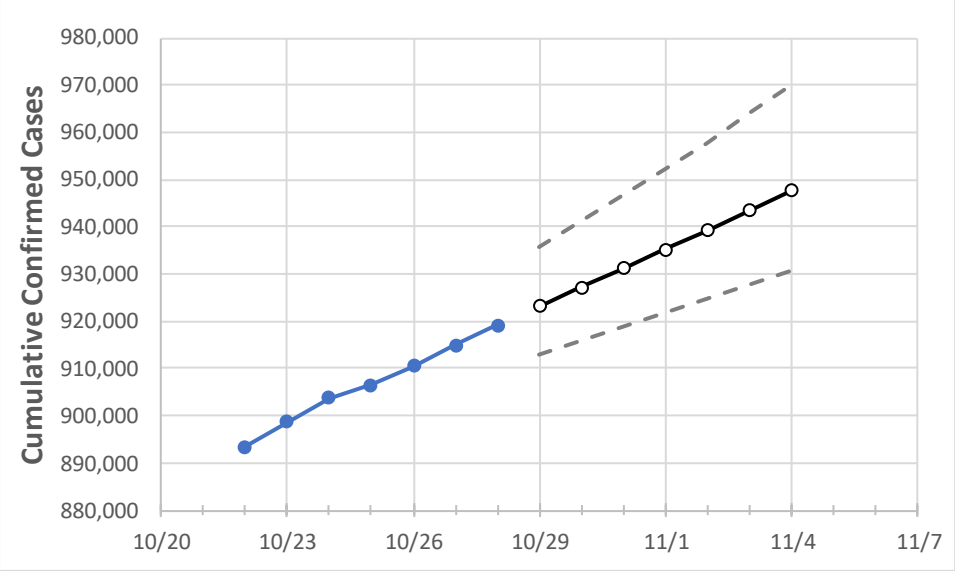
IEM's Modeling Lead

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:						
	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1	11/2	11/3	11/4
California	906,596	910,438	914,888	919,276	923,176	927,127	931,129	935,184	939,290	943,450	947,664

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:						
	10/25	10/26	10/27	10/28	10/29	10/30	10/31	11/1	11/2	11/3	11/4
Alameda	23,312	23,391	23,471	23,576	23,678	23,783	23,892	24,004	24,120	24,240	24,363
Contra Costa	18,621	18,694	18,763	18,817	18,884	18,951	19,018	19,086	19,154	19,222	19,291
Fresno	30,752	30,858	30,969	31,096	31,222	31,351	31,484	31,620	31,760	31,904	32,052
Kern	33,813	33,881	33,928	34,027	34,091	34,154	34,218	34,282	34,347	34,411	34,476
Los Angeles	299,760	300,614	302,077	303,369	304,451	305,545	306,651	307,769	308,899	310,042	311,197
Marin	7,074	7,089	7,096	7,099	7,107	7,114	7,121	7,128	7,135	7,142	7,148
Monterey	11,372	11,399	11,419	11,472	11,514	11,555	11,596	11,636	11,676	11,716	11,755
Orange	58,573	58,725	58,980	59,213	59,441	59,674	59,912	60,155	60,404	60,657	60,916
Placer	4,093	4,178	4,207	4,248	4,265	4,282	4,300	4,318	4,336	4,355	4,374
Riverside	65,902	66,732	66,993	67,299	67,572	67,854	68,146	68,447	68,758	69,080	69,412
Sacramento	25,372	25,445	25,601	25,750	25,878	26,009	26,143	26,280	26,419	26,561	26,706
San Bernardino	62,619	62,774	63,367	63,850	64,174	64,508	64,850	65,202	65,563	65,935	66,316
San Diego	54,583	54,941	55,210	55,540	55,863	56,190	56,522	56,858	57,198	57,544	57,894
San Francisco	12,103	12,152	12,189	12,241	12,281	12,322	12,364	12,406	12,449	12,493	12,537
San Joaquin	21,663	21,696	21,729	21,906	21,934	21,963	21,991	22,020	22,048	22,077	22,105
San Luis Obispo	4,152	4,163	4,174	4,191	4,208	4,225	4,242	4,259	4,276	4,293	4,310
San Mateo	11,112	11,149	11,198	11,232	11,273	11,314	11,355	11,396	11,437	11,479	11,521
Santa Barbara	9,781	9,814	9,827	9,874	9,902	9,930	9,958	9,987	10,017	10,047	10,077
Santa Clara	24,144	24,313	24,425	24,558	24,696	24,837	24,981	25,129	25,281	25,435	25,594
Santa Cruz	2,788	2,802	2,808	2,821	2,833	2,844	2,855	2,867	2,878	2,890	2,901
Solano	7,351	7,384	7,445	7,480	7,522	7,564	7,607	7,650	7,694	7,737	7,782
Sonoma	9,312	9,402	9,494	9,569	9,637	9,705	9,773	9,842	9,912	9,982	10,053
Ventura	14,240	14,300	14,330	14,347	14,390	14,433	14,475	14,518	14,560	14,602	14,644

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:		
	10/25	10/26	10/27	10/28	10/30	11/1	11/3
Alameda	23,312	23,391	23,471	23,576	23,783 (4,757) [1,142] {571}	24,004 (4,801) [1,152] {576}	24,240 (4,848) [1,164] {582}
Contra Costa	18,621	18,694	18,763	18,817	18,951 (3,790) [910] {455}	19,086 (3,817) [916] {458}	19,222 (3,844) [923] {461}
Fresno	30,752	30,858	30,969	31,096	31,351 (6,270) [1,505] {752}	31,620 (6,324) [1,518] {759}	31,904 (6,381) [1,531] {766}
Kern	33,813	33,881	33,928	34,027	34,154 (6,831) [1,639] {820}	34,282 (6,856) [1,646] {823}	34,411 (6,882) [1,652] {826}
Los Angeles	299,760	300,614	302,077	303,369	305,545 (61,109) [14,666] {7,333}	307,769 (61,554) [14,773] {7,386}	310,042 (62,008) [14,882] {7,441}
Marin	7,074	7,089	7,096	7,099	7,114 (1,423) [341] {171}	7,128 (1,426) [342] {171}	7,142 (1,428) [343] {171}
Monterey	11,372	11,399	11,419	11,472	11,555 (2,311) [555] {277}	11,636 (2,327) [559] {279}	11,716 (2,343) [562] {281}
Orange	58,573	58,725	58,980	59,213	59,674 (11,935) [2,864] {1,432}	60,155 (12,031) [2,887] {1,444}	60,657 (12,131) [2,912] {1,456}
Placer	4,093	4,178	4,207	4,248	4,282 (856) [206] {103}	4,318 (864) [207] {104}	4,355 (871) [209] {105}
Riverside	65,902	66,732	66,993	67,299	67,854 (13,571) [3,257] {1,629}	68,447 (13,689) [3,285] {1,643}	69,080 (13,816) [3,316] {1,658}
Sacramento	25,372	25,445	25,601	25,750	26,009 (5,202) [1,248] {624}	26,280 (5,256) [1,261] {631}	26,561 (5,312) [1,275] {637}
San Bernardino	62,619	62,774	63,367	63,850	64,508 (12,902) [3,096] {1,548}	65,202 (13,040) [3,130] {1,565}	65,935 (13,187) [3,165] {1,582}
San Diego	54,583	54,941	55,210	55,540	56,190 (11,238) [2,697] {1,349}	56,858 (11,372) [2,729] {1,365}	57,544 (11,509) [2,762] {1,381}
San Francisco	12,103	12,152	12,189	12,241	12,322 (2,464) [591] {296}	12,406 (2,481) [596] {298}	12,493 (2,499) [600] {300}
San Joaquin	21,663	21,696	21,729	21,906	21,963 (4,393) [1,054] {527}	22,020 (4,404) [1,057] {528}	22,077 (4,415) [1,060] {530}
San Luis Obispo	4,152	4,163	4,174	4,191	4,225 (845) [203] {101}	4,259 (852) [204] {102}	4,293 (859) [206] {103}
San Mateo	11,112	11,149	11,198	11,232	11,314 (2,263) [543] {272}	11,396 (2,279) [547] {274}	11,479 (2,296) [551] {275}
Santa Barbara	9,781	9,814	9,827	9,874	9,930 (1,986) [477] {238}	9,987 (1,997) [479] {240}	10,047 (2,009) [482] {241}
Santa Clara	24,144	24,313	24,425	24,558	24,837 (4,967) [1,192] {596}	25,129 (5,026) [1,206] {603}	25,435 (5,087) [1,221] {610}
Santa Cruz	2,788	2,802	2,808	2,821	2,844 (569) [137] {68}	2,867 (573) [138] {69}	2,890 (578) [139] {69}
Solano	7,351	7,384	7,445	7,480	7,564 (1,513) [363] {182}	7,650 (1,530) [367] {184}	7,737 (1,547) [371] {186}
Sonoma	9,312	9,402	9,494	9,569	9,705 (1,941) [466] {233}	9,842 (1,968) [472] {236}	9,982 (1,996) [479] {240}
Ventura	14,240	14,300	14,330	14,347	14,433 (2,887) [693] {346}	14,518 (2,904) [697] {348}	14,602 (2,920) [701] {350}

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.