IEM's AI Modeling: Short-term COVID-19 Projections
Date: 8/17/20

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 20%, and are often within 10%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 8/17/20 12 p.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
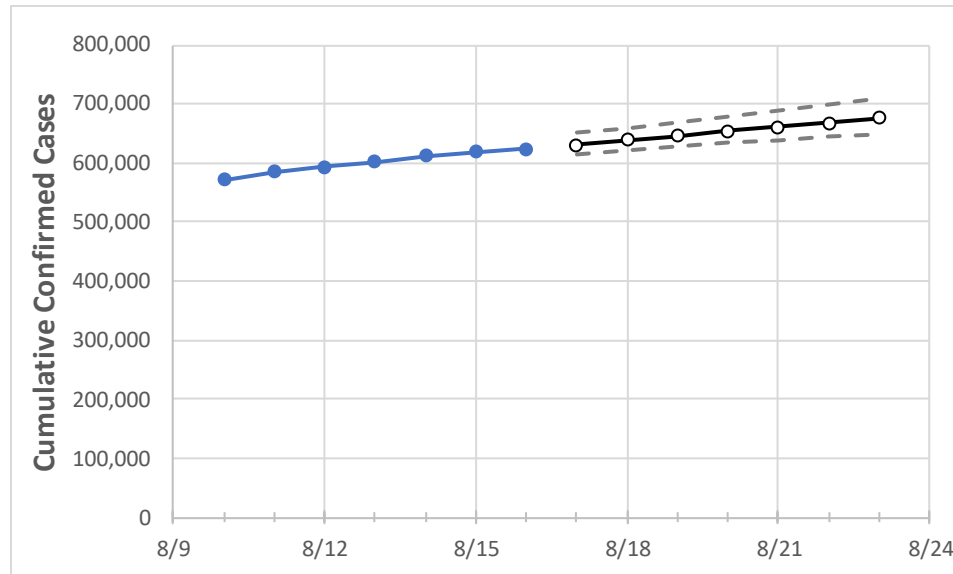
	Actual Confirmed Cases On:				Projected Cases For:						
	8/13	8/14	8/15	8/16	8/17	8/18	8/19	8/20	8/21	8/22	8/23
California	602,469	612,939	619,577	624,102	631,544	638,977	646,402	653,817	661,223	668,618	676,001

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:						
	8/13	8/14	8/15	8/16	8/17	8/18	8/19	8/20	8/21	8/22	8/23
Alameda	14,229	14,558	14,841	15,123	15,360	15,603	15,852	16,107	16,370	16,639	16,915
Contra Costa	10,482	10,756	11,013	11,228	11,485	11,751	12,027	12,313	12,609	12,916	13,234
Fresno	18,690	19,157	19,900	19,900	20,254	20,614	20,979	21,351	21,727	22,110	22,498
Kern	25,499	25,888	26,266	26,570	26,964	27,361	27,761	28,166	28,574	28,985	29,400
Los Angeles	216,139	218,693	220,762	221,950	223,799	225,629	227,439	229,231	231,005	232,759	234,495
Marin	5,669	5,707	5,707	5,707	5,763	5,821	5,880	5,940	6,003	6,066	6,132
Monterey	5,803	5,890	5,890	5,890	5,976	6,063	6,151	6,239	6,329	6,420	6,512
Orange	42,171	42,854	43,367	43,709	44,016	44,319	44,619	44,916	45,210	45,501	45,788
Placer	2,486	2,543	2,582	2,600	2,642	2,686	2,730	2,774	2,820	2,866	2,913
Riverside	44,679	45,662	45,662	45,662	46,331	47,014	47,710	48,419	49,142	49,878	50,629
Sacramento	13,216	13,615	13,615	13,615	13,919	14,234	14,561	14,899	15,249	15,611	15,986
San Bernardino	38,760	39,374	40,338	41,124	41,647	42,176	42,712	43,253	43,801	44,354	44,914
San Diego	33,659	34,065	34,344	34,678	34,957	35,232	35,503	35,770	36,033	36,292	36,547
San Francisco	7,944	8,053	8,157	8,292	8,394	8,496	8,600	8,706	8,812	8,920	9,029
San Joaquin	14,276	14,651	14,651	14,651	14,846	15,044	15,244	15,446	15,651	15,858	16,068
San Luis Obispo	2,324	2,439	2,439	2,439	2,484	2,530	2,576	2,624	2,672	2,722	2,772
San Mateo	6,640	6,803	6,952	6,952	7,051	7,153	7,258	7,367	7,480	7,596	7,716
Santa Barbara	7,148	7,274	7,274	7,274	7,330	7,385	7,440	7,494	7,547	7,601	7,653
Santa Clara	13,340	13,856	14,207	14,429	14,705	14,988	15,278	15,575	15,880	16,193	16,514
Santa Cruz	1,357	1,371	1,420	1,454	1,471	1,487	1,504	1,522	1,539	1,557	1,575
Solano	4,534	4,596	4,596	4,596	4,679	4,763	4,849	4,936	5,025	5,115	5,206
Sonoma	3,859	4,063	4,157	4,293	4,379	4,468	4,559	4,654	4,751	4,852	4,956
Ventura	8,909	9,090	9,090	9,090	9,199	9,308	9,418	9,529	9,640	9,752	9,865

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:		
	8/13	8/14	8/15	8/16	8/18	8/20	8/22
Alameda	14,229	14,558	14,841	15,123	15,603 (3,121) [749] {374}	16,107 (3,221) [773] {387}	16,639 (3,328) [799] {399}
Contra Costa	10,482	10,756	11,013	11,228	11,751 (2,350) [564] {282}	12,313 (2,463) [591] {296}	12,916 (2,583) [620] {310}
Fresno	18,690	19,157	19,900	19,900	20,614 (4,123) [989] {495}	21,351 (4,270) [1,025] {512}	22,110 (4,422) [1,061] {531}
Kern	25,499	25,888	26,266	26,570	27,361 (5,472) [1,313] {657}	28,166 (5,633) [1,352] {676}	28,985 (5,797) [1,391] {696}
Los Angeles	216,139	218,693	220,762	221,950	225,629 (45,126) [10,830] {5,415}	229,231 (45,846) [11,003] {5,502}	232,759 (46,552) [11,172] {5,586}
Marin	5,669	5,707	5,707	5,707	5,821 (1,164) [279] {140}	5,940 (1,188) [285] {143}	6,066 (1,213) [291] {146}
Monterey	5,803	5,890	5,890	5,890	6,063 (1,213) [291] {146}	6,239 (1,248) [299] {150}	6,420 (1,284) [308] {154}
Orange	42,171	42,854	43,367	43,709	44,319 (8,864) [2,127] {1,064}	44,916 (8,983) [2,156] {1,078}	45,501 (9,100) [2,184] {1,092}
Placer	2,486	2,543	2,582	2,600	2,686 (537) [129] {64}	2,774 (555) [133] {67}	2,866 (573) [138] {69}
Riverside	44,679	45,662	45,662	45,662	47,014 (9,403) [2,257] {1,128}	48,419 (9,684) [2,324] {1,162}	49,878 (9,976) [2,394] {1,197}
Sacramento	13,216	13,615	13,615	13,615	14,234 (2,847) [683] {342}	14,899 (2,980) [715] {358}	15,611 (3,122) [749] {375}
San Bernardino	38,760	39,374	40,338	41,124	42,176 (8,435) [2,024] {1,012}	43,253 (8,651) [2,076] {1,038}	44,354 (8,871) [2,129] {1,065}
San Diego	33,659	34,065	34,344	34,678	35,232 (7,046) [1,691] {846}	35,770 (7,154) [1,717] {858}	36,292 (7,258) [1,742] {871}
San Francisco	7,944	8,053	8,157	8,292	8,496 (1,699) [408] {204}	8,706 (1,741) [418] {209}	8,920 (1,784) [428] {214}
San Joaquin	14,276	14,651	14,651	14,651	15,044 (3,009) [722] {361}	15,446 (3,089) [741] {371}	15,858 (3,172) [761] {381}
San Luis Obispo	2,324	2,439	2,439	2,439	2,530 (506) [121] {61}	2,624 (525) [126] {63}	2,722 (544) [131] {65}
San Mateo	6,640	6,803	6,952	6,952	7,153 (1,431) [343] {172}	7,367 (1,473) [354] {177}	7,596 (1,519) [365] {182}
Santa Barbara	7,148	7,274	7,274	7,274	7,385 (1,477) [354] {177}	7,494 (1,499) [360] {180}	7,601 (1,520) [365] {182}
Santa Clara	13,340	13,856	14,207	14,429	14,988 (2,998) [719] {360}	15,575 (3,115) [748] {374}	16,193 (3,239) [777] {389}
Santa Cruz	1,357	1,371	1,420	1,454	1,487 (297) [71] {36}	1,522 (304) [73] {37}	1,557 (311) [75] {37}
Solano	4,534	4,596	4,596	4,596	4,763 (953) [229] {114}	4,936 (987) [237] {118}	5,115 (1,023) [245] {123}
Sonoma	3,859	4,063	4,157	4,293	4,468 (894) [214] {107}	4,654 (931) [223] {112}	4,852 (970) [233] {116}
Ventura	8,909	9,090	9,090	9,090	9,308 (1,862) [447] {223}	9,529 (1,906) [457] {229}	9,752 (1,950) [468] {234}

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.