IEM's AI Modeling: Short-term COVID-19 Projections
Date: 10/13/20

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 10/13/20 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
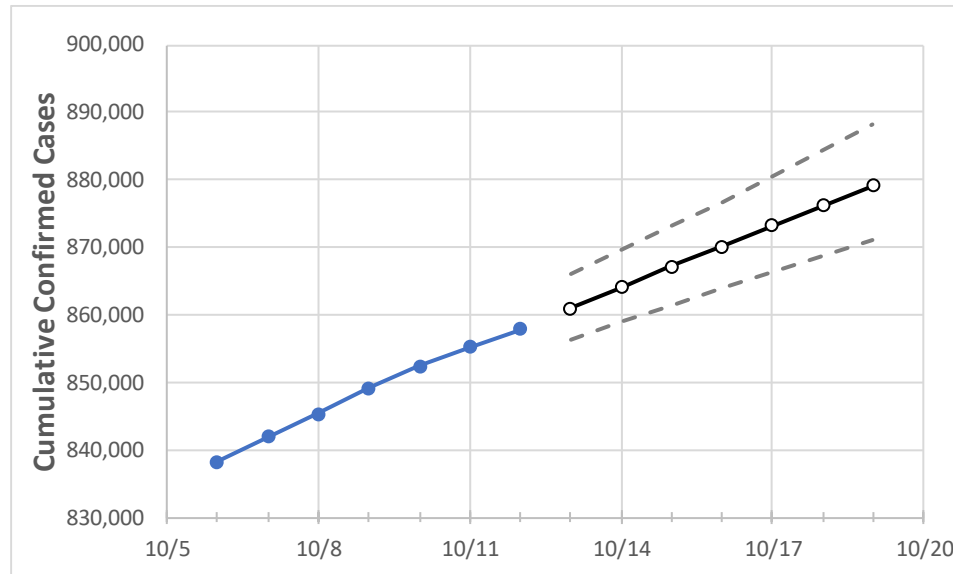
	Actual Confirmed Cases On:				Projected Cases For:						
	10/9	10/10	10/11	10/12	10/13	10/14	10/15	10/16	10/17	10/18	10/19
California	849,076	852,410	855,190	857,913	860,993	864,060	867,112	870,151	873,176	876,187	879,185

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:						
	10/9	10/10	10/11	10/12	10/13	10/14	10/15	10/16	10/17	10/18	10/19
Alameda	21,942	22,072	22,149	22,216	22,258	22,298	22,338	22,376	22,413	22,449	22,484
Contra Costa	17,478	17,546	17,624	17,732	17,800	17,867	17,934	17,999	18,064	18,128	18,191
Fresno	29,111	29,208	29,286	29,419	29,481	29,542	29,602	29,661	29,719	29,776	29,831
Kern	32,741	32,831	32,878	32,966	33,020	33,074	33,127	33,179	33,231	33,282	33,333
Los Angeles	279,909	281,165	282,135	282,982	284,011	285,045	286,086	287,132	288,185	289,244	290,309
Marin	6,854	6,871	6,877	6,902	6,913	6,923	6,933	6,944	6,954	6,964	6,974
Monterey	10,560	10,587	10,626	10,659	10,697	10,734	10,771	10,807	10,842	10,876	10,910
Orange	55,345	55,531	55,775	55,892	56,056	56,220	56,384	56,548	56,712	56,877	57,041
Placer	3,750	3,754	3,757	3,787	3,795	3,803	3,811	3,819	3,827	3,834	3,841
Riverside	61,824	61,835	61,845	62,112	62,192	62,269	62,344	62,417	62,488	62,556	62,623
Sacramento	23,523	23,649	23,689	23,778	23,854	23,929	24,003	24,075	24,146	24,216	24,284
San Bernardino	57,517	57,834	57,974	58,125	58,302	58,479	58,656	58,834	59,013	59,193	59,373
San Diego	49,823	50,143	50,551	50,746	51,036	51,329	51,624	51,923	52,224	52,527	52,834
San Francisco	11,608	11,620	11,663	11,666	11,683	11,700	11,716	11,731	11,745	11,758	11,771
San Joaquin	20,828	20,828	20,828	20,828	20,884	20,941	20,999	21,059	21,120	21,182	21,246
San Luis Obispo	3,815	3,842	3,858	3,874	3,886	3,897	3,909	3,920	3,932	3,943	3,954
San Mateo	10,452	10,510	10,510	10,510	10,550	10,590	10,629	10,669	10,708	10,748	10,787
Santa Barbara	9,387	9,408	9,417	9,440	9,458	9,475	9,491	9,508	9,524	9,539	9,554
Santa Clara	22,312	22,419	22,555	22,644	22,738	22,833	22,927	23,021	23,115	23,210	23,304
Santa Cruz	2,552	2,563	2,589	2,595	2,605	2,614	2,623	2,632	2,641	2,650	2,659
Solano	6,750	6,750	6,750	6,750	6,781	6,813	6,845	6,877	6,910	6,943	6,977
Sonoma	8,270	8,352	8,422	8,500	8,590	8,684	8,781	8,882	8,986	9,094	9,207
Ventura	13,399	13,469	13,520	13,604	13,655	13,707	13,758	13,810	13,862	13,914	13,966

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:		
	10/9	10/10	10/11	10/12	10/14	10/16	10/18
Alameda	21,942	22,072	22,149	22,216	22,298 (4,460) [1,070] {535}	22,376 (4,475) [1,074] {537}	22,449 (4,490) [1,078] {539}
Contra Costa	17,478	17,546	17,624	17,732	17,867 (3,573) [858] {429}	17,999 (3,600) [864] {432}	18,128 (3,626) [870] {435}
Fresno	29,111	29,208	29,286	29,419	29,542 (5,908) [1,418] {709}	29,661 (5,932) [1,424] {712}	29,776 (5,955) [1,429] {715}
Kern	32,741	32,831	32,878	32,966	33,074 (6,615) [1,588] {794}	33,179 (6,636) [1,593] {796}	33,282 (6,656) [1,598] {799}
Los Angeles	279,909	281,165	282,135	282,982	285,045 (57,009) [13,682] {6,841}	287,132 (57,426) [13,782] {6,891}	289,244 (57,849) [13,884] {6,942}
Marin	6,854	6,871	6,877	6,902	6,923 (1,385) [332] {166}	6,944 (1,389) [333] {167}	6,964 (1,393) [334] {167}
Monterey	10,560	10,587	10,626	10,659	10,734 (2,147) [515] {258}	10,807 (2,161) [519] {259}	10,876 (2,175) [522] {261}
Orange	55,345	55,531	55,775	55,892	56,220 (11,244) [2,699] {1,349}	56,548 (11,310) [2,714] {1,357}	56,877 (11,375) [2,730] {1,365}
Placer	3,750	3,754	3,757	3,787	3,803 (761) [183] {91}	3,819 (764) [183] {92}	3,834 (767) [184] {92}
Riverside	61,824	61,835	61,845	62,112	62,269 (12,454) [2,989] {1,494}	62,417 (12,483) [2,996] {1,498}	62,556 (12,511) [3,003] {1,501}
Sacramento	23,523	23,649	23,689	23,778	23,929 (4,786) [1,149] {574}	24,075 (4,815) [1,156] {578}	24,216 (4,843) [1,162] {581}
San Bernardino	57,517	57,834	57,974	58,125	58,479 (11,696) [2,807] {1,403}	58,834 (11,767) [2,824] {1,412}	59,193 (11,839) [2,841] {1,421}
San Diego	49,823	50,143	50,551	50,746	51,329 (10,266) [2,464] {1,232}	51,923 (10,385) [2,492] {1,246}	52,527 (10,505) [2,521] {1,261}
San Francisco	11,608	11,620	11,663	11,666	11,700 (2,340) [562] {281}	11,731 (2,346) [563] {282}	11,758 (2,352) [564] {282}
San Joaquin	20,828	20,828	20,828	20,828	20,941 (4,188) [1,005] {503}	21,059 (4,212) [1,011] {505}	21,182 (4,236) [1,017] {508}
San Luis Obispo	3,815	3,842	3,858	3,874	3,897 (779) [187] {94}	3,920 (784) [188] {94}	3,943 (789) [189] {95}
San Mateo	10,452	10,510	10,510	10,510	10,590 (2,118) [508] {254}	10,669 (2,134) [512] {256}	10,748 (2,150) [516] {258}
Santa Barbara	9,387	9,408	9,417	9,440	9,475 (1,895) [455] {227}	9,508 (1,902) [456] {228}	9,539 (1,908) [458] {229}
Santa Clara	22,312	22,419	22,555	22,644	22,833 (4,567) [1,096] {548}	23,021 (4,604) [1,105] {553}	23,210 (4,642) [1,114] {557}
Santa Cruz	2,552	2,563	2,589	2,595	2,614 (523) [125] {63}	2,632 (526) [126] {63}	2,650 (530) [127] {64}
Solano	6,750	6,750	6,750	6,750	6,813 (1,363) [327] {164}	6,877 (1,375) [330] {165}	6,943 (1,389) [333] {167}
Sonoma	8,270	8,352	8,422	8,500	8,684 (1,737) [417] {208}	8,882 (1,776) [426] {213}	9,094 (1,819) [437] {218}
Ventura	13,399	13,469	13,520	13,604	13,707 (2,741) [658] {329}	13,810 (2,762) [663] {331}	13,914 (2,783) [668] {334}

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.