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

Date: 3/29/22

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 3/29/22 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.

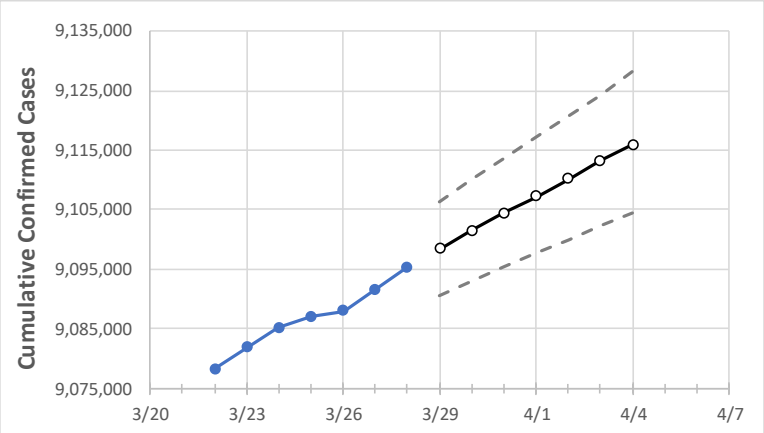
IEM's Modeling Lead

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:						
	3/25	3/26	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4
California	9,087,002	9,087,959	9,091,637	9,095,314	9,098,424	9,101,494	9,104,362	9,107,212	9,110,128	9,113,148	9,115,854

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 10%, and are often within 5%, of actual confirmed cases.

California Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	3/25	3/26	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4
Alameda	268,563	268,673	268,784	268,894	268,993	269,090	269,182	269,277	269,370	269,466	269,551
Contra Costa	201,231	201,297	201,362	201,427	201,507	201,592	201,673	201,744	201,820	201,900	201,980
Fresno	252,113	252,176	252,240	252,303	252,396	252,493	252,586	252,673	252,763	252,857	252,940
Kern	242,196	242,218	242,239	242,261	242,308	242,352	242,393	242,432	242,472	242,506	242,536
Lake	11,557	11,561	11,564	11,567	11,569	11,571	11,573	11,575	11,577	11,578	11,580
Los Angeles	2,829,091	2,830,048	2,830,576	2,831,103	2,832,310	2,833,525	2,834,714	2,835,850	2,837,105	2,838,326	2,839,580
Marin	35,548	35,566	35,585	35,603	35,624	35,645	35,665	35,685	35,705	35,726	35,744
Monterey	92,286	92,309	92,331	92,354	92,382	92,408	92,431	92,456	92,482	92,504	92,527
Orange	586,528	586,645	586,761	586,878	587,069	587,261	587,452	587,636	587,820	588,010	588,208
Placer	69,993	70,004	70,016	70,027	70,046	70,061	70,077	70,095	70,112	70,127	70,144
Riverside	618,212	618,260	618,309	618,357	618,460	618,552	618,640	618,731	618,819	618,912	618,985
Sacramento	302,447	302,529	302,610	302,692	302,771	302,846	302,925	302,993	303,063	303,137	303,209
San Bernardino	585,227	585,259	585,292	585,324	585,405	585,486	585,567	585,628	585,703	585,778	585,852
San Diego	801,214	801,377	801,540	801,703	802,090	802,471	802,858	803,201	803,559	803,916	804,275
San Francisco	132,702	132,790	132,879	132,967	133,070	133,168	133,266	133,366	133,466	133,566	133,676
San Joaquin	175,285	175,325	175,365	175,405	175,441	175,472	175,505	175,537	175,563	175,595	175,624
San Luis Obispo	56,151	56,166	56,182	56,197	56,221	56,246	56,268	56,292	56,313	56,335	56,356
San Mateo	127,251	127,291	127,330	127,370	127,416	127,462	127,505	127,546	127,589	127,632	127,678
Santa Barbara	90,293	90,282	90,272	90,261	90,277	90,292	90,306	90,319	90,335	90,348	90,360
Santa Clara	323,683	323,842	324,001	324,160	324,324	324,487	324,648	324,809	324,956	325,137	325,279
Santa Cruz	49,325	49,323	49,321	49,319	49,335	49,351	49,365	49,379	49,391	49,406	49,419
Solano	87,187	87,202	87,216	87,230	87,261	87,290	87,314	87,344	87,370	87,394	87,421
Sonoma	85,554	85,548	85,542	85,536	85,571	85,604	85,640	85,672	85,706	85,739	85,775
Ventura	181,992	182,027	182,063	182,098	182,140	182,186	182,225	182,270	182,310	182,353	182,394

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:		
	3/25	3/26	3/27	3/28	3/30	4/1	4/3
Alameda	268,563	268,673	268,784	268,894	269,090 (53,818) [12,916] {6,458}	269,277 (53,855) [12,925] {6,463}	269,466 (53,893) [12,934] {6,467}
Contra Costa	201,231	201,297	201,362	201,427	201,592 (40,318) [9,676] {4,838}	201,744 (40,349) [9,684] {4,842}	201,900 (40,380) [9,691] {4,846}
Fresno	252,113	252,176	252,240	252,303	252,493 (50,499) [12,120] {6,060}	252,673 (50,535) [12,128] {6,064}	252,857 (50,571) [12,137] {6,069}
Kern	242,196	242,218	242,239	242,261	242,352 (48,470) [11,633] {5,816}	242,432 (48,486) [11,637] {5,818}	242,506 (48,501) [11,640] {5,820}
Lake	11,557	11,561	11,564	11,567	11,571 (2,314) [555] {278}	11,575 (2,315) [556] {278}	11,578 (2,316) [556] {278}
Los Angeles	2,829,091	2,830,048	2,830,576	2,831,103	2,833,525 (566,705) [136,009] {68,005}	2,835,850 (567,170) [136,121] {68,060}	2,838,326 (567,665) [136,240] {68,120}
Marin	35,548	35,566	35,585	35,603	35,645 (7,129) [1,711] {855}	35,685 (7,137) [1,713] {856}	35,726 (7,145) [1,715] {857}
Monterey	92,286	92,309	92,331	92,354	92,408 (18,482) [4,436] {2,218}	92,456 (18,491) [4,438] {2,219}	92,504 (18,501) [4,440] {2,220}
Orange	586,528	586,645	586,761	586,878	587,261 (117,452) [28,189] {14,094}	587,636 (117,527) [28,207] {14,103}	588,010 (117,602) [28,224] {14,112}
Placer	69,993	70,004	70,016	70,027	70,061 (14,012) [3,363] {1,681}	70,095 (14,019) [3,365] {1,682}	70,127 (14,025) [3,366] {1,683}
Riverside	618,212	618,260	618,309	618,357	618,552 (123,710) [29,691] {14,845}	618,731 (123,746) [29,699] {14,850}	618,912 (123,782) [29,708] {14,854}
Sacramento	302,447	302,529	302,610	302,692	302,846 (60,569) [14,537] {7,268}	302,993 (60,599) [14,544] {7,272}	303,137 (60,627) [14,551] {7,275}
San Bernardino	585,227	585,259	585,292	585,324	585,486 (117,097) [28,103] {14,052}	585,628 (117,126) [28,110] {14,055}	585,778 (117,156) [28,117] {14,059}
San Diego	801,214	801,377	801,540	801,703	802,471 (160,494) [38,519] {19,259}	803,201 (160,640) [38,554] {19,277}	803,916 (160,783) [38,588] {19,294}
San Francisco	132,702	132,790	132,879	132,967	133,168 (26,634) [6,392] {3,196}	133,366 (26,673) [6,402] {3,201}	133,566 (26,713) [6,411] {3,206}
San Joaquin	175,285	175,325	175,365	175,405	175,472 (35,094) [8,423] {4,211}	175,537 (35,107) [8,426] {4,213}	175,595 (35,119) [8,429] {4,214}
San Luis Obispo	56,151	56,166	56,182	56,197	56,246 (11,249) [2,700] {1,350}	56,292 (11,258) [2,702] {1,351}	56,335 (11,267) [2,704] {1,352}
San Mateo	127,251	127,291	127,330	127,370	127,462 (25,492) [6,118] {3,059}	127,546 (25,509) [6,122] {3,061}	127,632 (25,526) [6,126] {3,063}
Santa Barbara	90,293	90,282	90,272	90,261	90,292 (18,058) [4,334] {2,167}	90,319 (18,064) [4,335] {2,168}	90,348 (18,070) [4,337] {2,168}
Santa Clara	323,683	323,842	324,001	324,160	324,487 (64,897) [15,575] {7,788}	324,809 (64,962) [15,591] {7,795}	325,137 (65,027) [15,607] {7,803}
Santa Cruz	49,325	49,323	49,321	49,319	49,351 (9,870) [2,369] {1,184}	49,379 (9,876) [2,370] {1,185}	49,406 (9,881) [2,371] {1,186}
Solano	87,187	87,202	87,216	87,230	87,290 (17,458) [4,190] {2,095}	87,344 (17,469) [4,192] {2,096}	87,394 (17,479) [4,195] {2,097}
Sonoma	85,554	85,548	85,542	85,536	85,604 (17,121) [4,109] {2,054}	85,672 (17,134) [4,112] {2,056}	85,739 (17,148) [4,115] {2,058}
Ventura	181,992	182,027	182,063	182,098	182,186 (36,437) [8,745] {4,372}	182,270 (36,454) [8,749] {4,374}	182,353 (36,471) [8,753] {4,376}

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.