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

Date: 8/19/20

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 8/19/20 1 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.

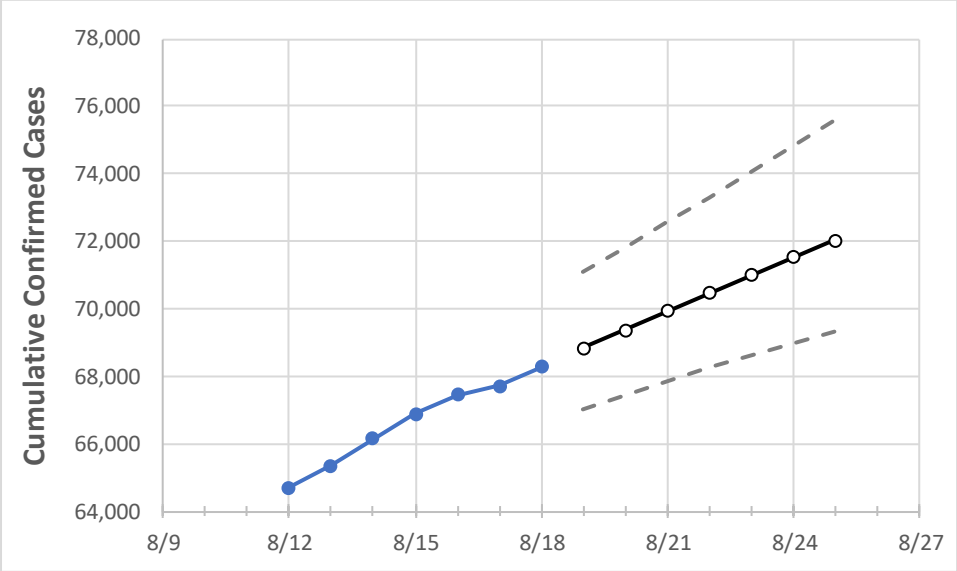
IEM's Modeling Lead

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.

Washington State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	8/15	8/16	8/17	8/18	8/19	8/20	8/21	8/22	8/23	8/24	8/25
Washington	66,883	67,459	67,721	68,264	68,823	69,375	69,919	70,456	70,986	71,509	72,025

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.

Washington Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	8/15	8/16	8/17	8/18	8/19	8/20	8/21	8/22	8/23	8/24	8/25
Benton	3,845	3,851	3,860	3,892	3,905	3,917	3,928	3,940	3,950	3,961	3,971
Clark	1,927	1,933	1,938	1,979	1,995	2,012	2,028	2,044	2,061	2,077	2,094
Grant	1,746	1,821	1,833	1,872	1,912	1,953	1,996	2,041	2,087	2,135	2,185
Island	250	253	254	254	254	255	255	256	256	257	257
King	17,491	17,623	17,745	17,908	18,053	18,197	18,343	18,488	18,633	18,779	18,925
Kitsap	801	806	812	826	834	841	848	855	862	868	875
Pierce	6,094	6,150	6,177	6,212	6,258	6,304	6,348	6,392	6,434	6,476	6,516
Skagit	922	932	934	936	940	944	948	952	956	960	964
Snohomish	5,716	5,730	5,741	5,800	5,830	5,859	5,888	5,916	5,944	5,971	5,998
Spokane	4,758	4,791	4,806	4,836	4,872	4,907	4,941	4,974	5,006	5,037	5,067
Thurston	781	790	798	806	815	824	833	842	851	860	869
Whatcom	1,018	1,024	1,029	1,034	1,038	1,042	1,046	1,050	1,053	1,057	1,060
Yakima	10,590	10,625	10,645	10,665	10,691	10,717	10,742	10,766	10,790	10,812	10,835

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.*

Washington Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	8/15	8/16	8/17	8/18	8/20	8/22	8/24
Benton	3,845	3,851	3,860	3,892	3,917 (783) [188] {94}	3,940 (788) [189] {95}	3,961 (792) [190] {95}
Clark	1,927	1,933	1,938	1,979	2,012 (402) [97] {48}	2,044 (409) [98] {49}	2,077 (415) [100] {50}
Grant	1,746	1,821	1,833	1,872	1,953 (391) [94] {47}	2,041 (408) [98] {49}	2,135 (427) [102] {51}
Island	250	253	254	254	255 (51) [12] {6}	256 (51) [12] {6}	257 (51) [12] {6}
King	17,491	17,623	17,745	17,908	18,197 (3,639) [873] {437}	18,488 (3,698) [887] {444}	18,779 (3,756) [901] {451}
Kitsap	801	806	812	826	841 (168) [40] {20}	855 (171) [41] {21}	868 (174) [42] {21}
Pierce	6,094	6,150	6,177	6,212	6,304 (1,261) [303] {151}	6,392 (1,278) [307] {153}	6,476 (1,295) [311] {155}
Skagit	922	932	934	936	944 (189) [45] {23}	952 (190) [46] {23}	960 (192) [46] {23}
Snohomish	5,716	5,730	5,741	5,800	5,859 (1,172) [281] {141}	5,916 (1,183) [284] {142}	5,971 (1,194) [287] {143}
Spokane	4,758	4,791	4,806	4,836	4,907 (981) [236] {118}	4,974 (995) [239] {119}	5,037 (1,007) [242] {121}
Thurston	781	790	798	806	824 (165) [40] {20}	842 (168) [40] {20}	860 (172) [41] {21}
Whatcom	1,018	1,024	1,029	1,034	1,042 (208) [50] {25}	1,050 (210) [50] {25}	1,057 (211) [51] {25}
Yakima	10,590	10,625	10,645	10,665	10,717 (2,143) [514] {257}	10,766 (2,153) [517] {258}	10,812 (2,162) [519] {259}

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.