

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

Date: 3/15/21

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 3/15/21 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.

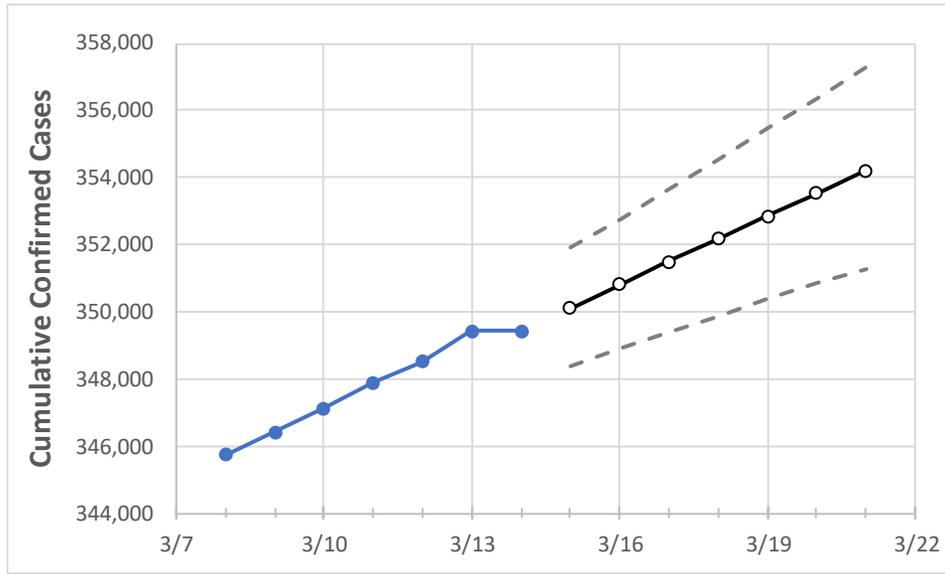
IEM's Modeling Lead

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.

Washington State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	3/11	3/12	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21
Washington	347,884	348,516	349,425	349,425	350,117	350,819	351,500	352,176	352,844	353,522	354,196

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.

Washington Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	3/11	3/12	3/13	3/14	3/15	3/16	3/17	3/18	3/19	3/20	3/21
Benton	15,265	15,283	15,310	15,310	15,330	15,350	15,370	15,389	15,409	15,428	15,447
Clark	19,308	19,343	19,395	19,395	19,430	19,464	19,498	19,532	19,567	19,601	19,636
Grant	7,812	7,821	7,834	7,834	7,844	7,853	7,862	7,871	7,880	7,889	7,897
Island	1,408	1,411	1,416	1,416	1,426	1,436	1,447	1,458	1,470	1,482	1,494
King	85,824	86,002	86,234	86,234	86,399	86,562	86,726	86,891	87,057	87,222	87,390
Kitsap	5,942	5,952	5,990	5,990	6,007	6,025	6,043	6,061	6,080	6,099	6,117
Pierce	39,578	39,728	39,857	39,857	39,972	40,085	40,203	40,315	40,427	40,540	40,656
Skagit	4,579	4,587	4,601	4,601	4,612	4,624	4,636	4,647	4,659	4,672	4,683
Snohomish	30,790	30,832	30,883	30,883	30,924	30,963	31,001	31,039	31,075	31,112	31,145
Spokane	37,099	37,153	37,228	37,228	37,278	37,328	37,376	37,422	37,469	37,514	37,559
Thurston	7,410	7,429	7,460	7,460	7,475	7,491	7,506	7,520	7,534	7,548	7,562
Whatcom	7,075	7,099	7,137	7,137	7,161	7,184	7,207	7,229	7,251	7,273	7,295
Yakima	27,213	27,241	27,313	27,313	27,370	27,427	27,487	27,547	27,607	27,667	27,726

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:											
	3/11	3/12	3/13	3/14	3/16				3/18				3/20			
Benton	15,265	15,283	15,310	15,310	15,350	(3,070)	[737]	{368}	15,389	(3,078)	[739]	{369}	15,428	(3,086)	[741]	{370}
Clark	19,308	19,343	19,395	19,395	19,464	(3,893)	[934]	{467}	19,532	(3,906)	[938]	{469}	19,601	(3,920)	[941]	{470}
Grant	7,812	7,821	7,834	7,834	7,853	(1,571)	[377]	{188}	7,871	(1,574)	[378]	{189}	7,889	(1,578)	[379]	{189}
Island	1,408	1,411	1,416	1,416	1,436	(287)	[69]	{34}	1,458	(292)	[70]	{35}	1,482	(296)	[71]	{36}
King	85,824	86,002	86,234	86,234	86,562	(17,312)	[4,155]	{2,077}	86,891	(17,378)	[4,171]	{2,085}	87,222	(17,444)	[4,187]	{2,093}
Kitsap	5,942	5,952	5,990	5,990	6,025	(1,205)	[289]	{145}	6,061	(1,212)	[291]	{145}	6,099	(1,220)	[293]	{146}
Pierce	39,578	39,728	39,857	39,857	40,085	(8,017)	[1,924]	{962}	40,315	(8,063)	[1,935]	{968}	40,540	(8,108)	[1,946]	{973}
Skagit	4,579	4,587	4,601	4,601	4,624	(925)	[222]	{111}	4,647	(929)	[223]	{112}	4,672	(934)	[224]	{112}
Snohomish	30,790	30,832	30,883	30,883	30,963	(6,193)	[1,486]	{743}	31,039	(6,208)	[1,490]	{745}	31,112	(6,222)	[1,493]	{747}
Spokane	37,099	37,153	37,228	37,228	37,328	(7,466)	[1,792]	{896}	37,422	(7,484)	[1,796]	{898}	37,514	(7,503)	[1,801]	{900}
Thurston	7,410	7,429	7,460	7,460	7,491	(1,498)	[360]	{180}	7,520	(1,504)	[361]	{180}	7,548	(1,510)	[362]	{181}
Whatcom	7,075	7,099	7,137	7,137	7,184	(1,437)	[345]	{172}	7,229	(1,446)	[347]	{174}	7,273	(1,455)	[349]	{175}
Yakima	27,213	27,241	27,313	27,313	27,427	(5,485)	[1,316]	{658}	27,547	(5,509)	[1,322]	{661}	27,667	(5,533)	[1,328]	{664}

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.