

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

Date: 4/28/21

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 4/28/21 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.

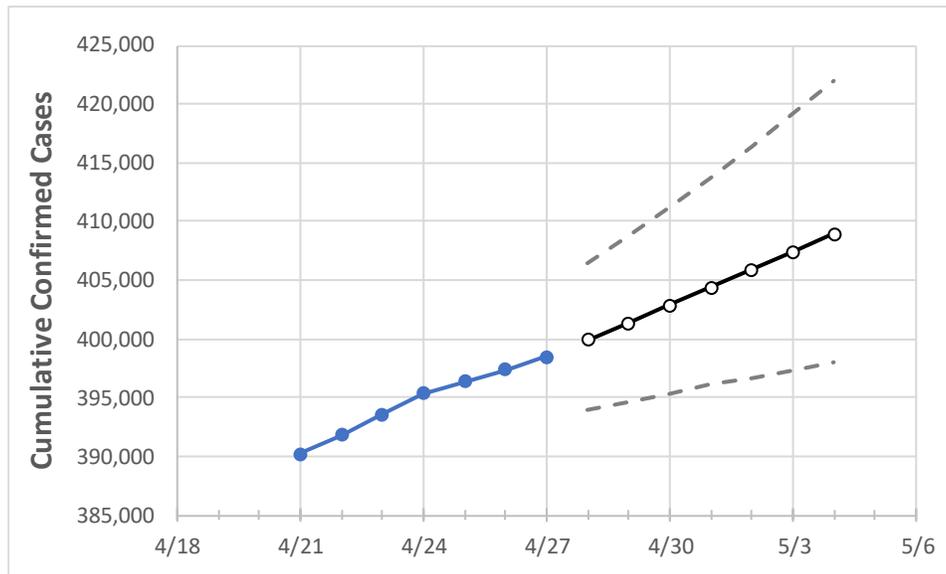
IEM's Modeling Lead

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:							
	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3	5/4	
Washington	395,312	396,365	397,417	398,509	399,912	401,370	402,848	404,386	405,885	407,420	408,966	

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:							
	4/24	4/25	4/26	4/27	4/28	4/29	4/30	5/1	5/2	5/3	5/4	
Benton	16,449	16,468	16,487	16,516	16,548	16,579	16,610	16,641	16,671	16,701	16,731	
Clark	21,950	22,014	22,077	22,196	22,293	22,395	22,498	22,604	22,714	22,827	22,942	
Grant	8,494	8,510	8,525	8,531	8,558	8,586	8,614	8,644	8,674	8,704	8,736	
Island	1,601	1,607	1,612	1,621	1,631	1,641	1,652	1,664	1,676	1,689	1,702	
King	99,551	99,914	100,276	100,477	100,880	101,283	101,696	102,120	102,522	102,932	103,349	
Kitsap	7,330	7,369	7,407	7,451	7,496	7,543	7,592	7,639	7,687	7,737	7,785	
Pierce	47,711	47,983	48,255	48,398	48,673	48,954	49,241	49,534	49,835	50,143	50,459	
Skagit	5,211	5,236	5,260	5,289	5,318	5,347	5,378	5,408	5,441	5,473	5,505	
Snohomish	35,133	35,224	35,314	35,483	35,625	35,766	35,913	36,061	36,204	36,350	36,497	
Spokane	40,822	40,889	40,955	41,052	41,155	41,258	41,361	41,463	41,562	41,669	41,776	
Thurston	8,681	8,706	8,731	8,774	8,820	8,870	8,920	8,971	9,022	9,075	9,130	
Whatcom	8,207	8,237	8,266	8,296	8,331	8,367	8,402	8,438	8,475	8,513	8,549	
Yakima	29,185	29,245	29,305	29,329	29,373	29,417	29,458	29,499	29,542	29,586	29,626	

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:											
	4/24	4/25	4/26	4/27	4/29				5/1				5/3			
Benton	16,449	16,468	16,487	16,516	16,579	(3,316)	[796]	{398}	16,641	(3,328)	[799]	{399}	16,701	(3,340)	[802]	{401}
Clark	21,950	22,014	22,077	22,196	22,395	(4,479)	[1,075]	{537}	22,604	(4,521)	[1,085]	{543}	22,827	(4,565)	[1,096]	{548}
Grant	8,494	8,510	8,525	8,531	8,586	(1,717)	[412]	{206}	8,644	(1,729)	[415]	{207}	8,704	(1,741)	[418]	{209}
Island	1,601	1,607	1,612	1,621	1,641	(328)	[79]	{39}	1,664	(333)	[80]	{40}	1,689	(338)	[81]	{41}
King	99,551	99,914	100,276	100,477	101,283	(20,257)	[4,862]	{2,431}	102,120	(20,424)	[4,902]	{2,451}	102,932	(20,586)	[4,941]	{2,470}
Kitsap	7,330	7,369	7,407	7,451	7,543	(1,509)	[362]	{181}	7,639	(1,528)	[367]	{183}	7,737	(1,547)	[371]	{186}
Pierce	47,711	47,983	48,255	48,398	48,954	(9,791)	[2,350]	{1,175}	49,534	(9,907)	[2,378]	{1,189}	50,143	(10,029)	[2,407]	{1,203}
Skagit	5,211	5,236	5,260	5,289	5,347	(1,069)	[257]	{128}	5,408	(1,082)	[260]	{130}	5,473	(1,095)	[263]	{131}
Snohomish	35,133	35,224	35,314	35,483	35,766	(7,153)	[1,717]	{858}	36,061	(7,212)	[1,731]	{865}	36,350	(7,270)	[1,745]	{872}
Spokane	40,822	40,889	40,955	41,052	41,258	(8,252)	[1,980]	{990}	41,463	(8,293)	[1,990]	{995}	41,669	(8,334)	[2,000]	{1,000}
Thurston	8,681	8,706	8,731	8,774	8,870	(1,774)	[426]	{213}	8,971	(1,794)	[431]	{215}	9,075	(1,815)	[436]	{218}
Whatcom	8,207	8,237	8,266	8,296	8,367	(1,673)	[402]	{201}	8,438	(1,688)	[405]	{203}	8,513	(1,703)	[409]	{204}
Yakima	29,185	29,245	29,305	29,329	29,417	(5,883)	[1,412]	{706}	29,499	(5,900)	[1,416]	{708}	29,586	(5,917)	[1,420]	{710}

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.