

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

Date: 4/15/21

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 4/15/21 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.

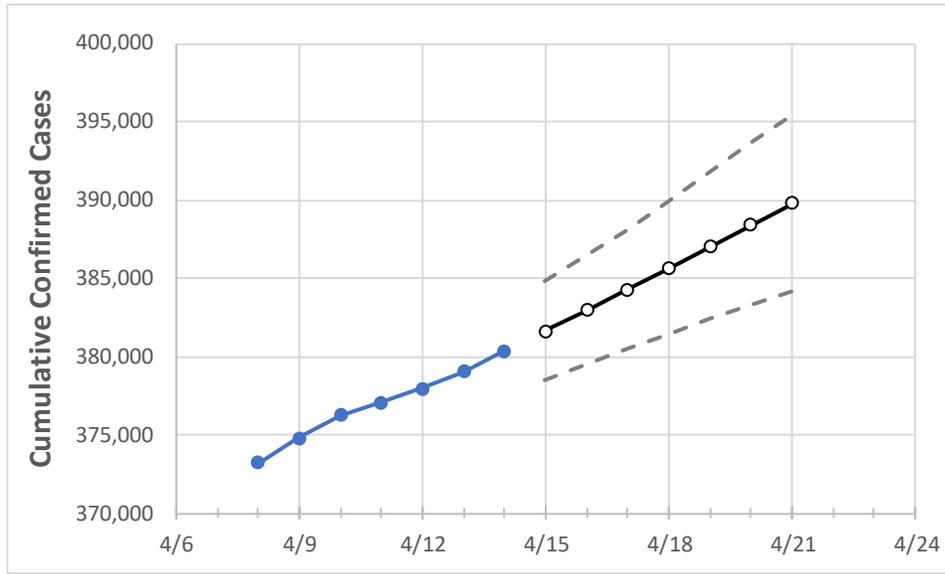
IEM's Modeling Lead

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:						
	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	4/21
Washington	377,091	377,952	379,056	380,339	381,653	382,954	384,283	385,622	386,987	388,385	389,766

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:						
	4/11	4/12	4/13	4/14	4/15	4/16	4/17	4/18	4/19	4/20	4/21
Benton	15,979	15,998	16,030	16,074	16,106	16,138	16,172	16,205	16,239	16,273	16,308
Clark	20,818	20,846	20,972	21,041	21,107	21,173	21,239	21,307	21,380	21,452	21,526
Grant	8,160	8,163	8,184	8,200	8,210	8,220	8,230	8,240	8,251	8,260	8,270
Island	1,516	1,517	1,525	1,526	1,529	1,533	1,536	1,540	1,543	1,547	1,551
King	94,454	94,775	95,001	95,347	95,684	96,032	96,373	96,723	97,069	97,420	97,779
Kitsap	6,769	6,799	6,836	6,882	6,922	6,963	7,006	7,049	7,094	7,138	7,185
Pierce	44,726	44,902	45,060	45,203	45,403	45,603	45,807	46,015	46,229	46,441	46,658
Skagit	4,913	4,924	4,943	4,967	4,988	5,010	5,035	5,060	5,086	5,112	5,139
Snohomish	33,356	33,433	33,566	33,698	33,840	33,980	34,129	34,280	34,439	34,603	34,765
Spokane	39,368	39,426	39,517	39,660	39,763	39,866	39,974	40,083	40,193	40,307	40,422
Thurston	8,119	8,136	8,173	8,198	8,226	8,254	8,282	8,311	8,340	8,368	8,397
Whatcom	7,815	7,822	7,852	7,881	7,906	7,930	7,955	7,980	8,006	8,032	8,058
Yakima	28,570	28,605	28,635	28,698	28,744	28,789	28,835	28,879	28,923	28,967	29,010

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:											
	4/11	4/12	4/13	4/14	4/16				4/18				4/20			
Benton	15,979	15,998	16,030	16,074	16,138	(3,228)	[775]	{387}	16,205	(3,241)	[778]	{389}	16,273	(3,255)	[781]	{391}
Clark	20,818	20,846	20,972	21,041	21,173	(4,235)	[1,016]	{508}	21,307	(4,261)	[1,023]	{511}	21,452	(4,290)	[1,030]	{515}
Grant	8,160	8,163	8,184	8,200	8,220	(1,644)	[395]	{197}	8,240	(1,648)	[396]	{198}	8,260	(1,652)	[397]	{198}
Island	1,516	1,517	1,525	1,526	1,533	(307)	[74]	{37}	1,540	(308)	[74]	{37}	1,547	(309)	[74]	{37}
King	94,454	94,775	95,001	95,347	96,032	(19,206)	[4,610]	{2,305}	96,723	(19,345)	[4,643]	{2,321}	97,420	(19,484)	[4,676]	{2,338}
Kitsap	6,769	6,799	6,836	6,882	6,963	(1,393)	[334]	{167}	7,049	(1,410)	[338]	{169}	7,138	(1,428)	[343]	{171}
Pierce	44,726	44,902	45,060	45,203	45,603	(9,121)	[2,189]	{1,094}	46,015	(9,203)	[2,209]	{1,104}	46,441	(9,288)	[2,229]	{1,115}
Skagit	4,913	4,924	4,943	4,967	5,010	(1,002)	[241]	{120}	5,060	(1,012)	[243]	{121}	5,112	(1,022)	[245]	{123}
Snohomish	33,356	33,433	33,566	33,698	33,980	(6,796)	[1,631]	{816}	34,280	(6,856)	[1,645]	{823}	34,603	(6,921)	[1,661]	{830}
Spokane	39,368	39,426	39,517	39,660	39,866	(7,973)	[1,914]	{957}	40,083	(8,017)	[1,924]	{962}	40,307	(8,061)	[1,935]	{967}
Thurston	8,119	8,136	8,173	8,198	8,254	(1,651)	[396]	{198}	8,311	(1,662)	[399]	{199}	8,368	(1,674)	[402]	{201}
Whatcom	7,815	7,822	7,852	7,881	7,930	(1,586)	[381]	{190}	7,980	(1,596)	[383]	{192}	8,032	(1,606)	[386]	{193}
Yakima	28,570	28,605	28,635	28,698	28,789	(5,758)	[1,382]	{691}	28,879	(5,776)	[1,386]	{693}	28,967	(5,793)	[1,390]	{695}

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.