

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

Date: 4/21/21

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 4/21/21 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.

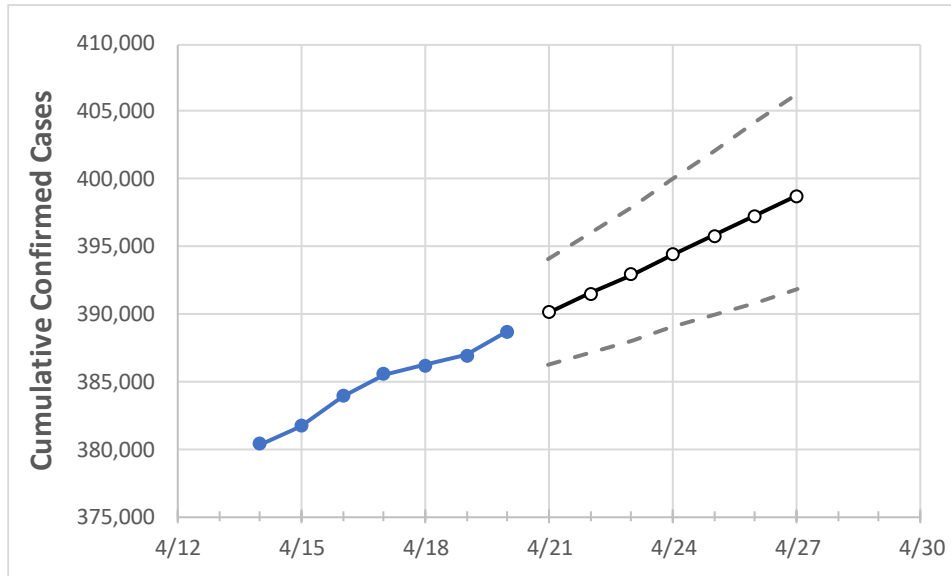
IEM's Modeling Lead

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:						
	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27
Washington	385,549	386,235	386,920	388,718	390,102	391,515	392,928	394,361	395,797	397,280	398,777

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:						
	4/17	4/18	4/19	4/20	4/21	4/22	4/23	4/24	4/25	4/26	4/27
Benton	16,206	16,220	16,233	16,281	16,318	16,356	16,394	16,433	16,472	16,513	16,556
Clark	21,334	21,394	21,453	21,521	21,602	21,683	21,764	21,850	21,936	22,027	22,119
Grant	8,271	8,284	8,297	8,402	8,418	8,434	8,451	8,469	8,487	8,505	8,525
Island	1,549	1,552	1,555	1,563	1,569	1,576	1,583	1,590	1,598	1,606	1,614
King	96,808	97,019	97,230	97,712	98,090	98,481	98,860	99,247	99,646	100,052	100,465
Kitsap	7,054	7,072	7,089	7,150	7,193	7,240	7,287	7,333	7,384	7,433	7,484
Pierce	45,950	46,151	46,351	46,602	46,827	47,058	47,290	47,532	47,773	48,018	48,267
Skagit	5,048	5,061	5,074	5,103	5,128	5,153	5,180	5,207	5,236	5,264	5,294
Snohomish	34,237	34,287	34,337	34,524	34,668	34,817	34,965	35,116	35,272	35,437	35,597
Spokane	40,069	40,111	40,153	40,357	40,478	40,603	40,731	40,861	40,998	41,136	41,281
Thurston	8,386	8,397	8,407	8,441	8,477	8,514	8,553	8,593	8,632	8,675	8,718
Whatcom	8,018	8,015	8,011	8,049	8,085	8,120	8,156	8,193	8,231	8,270	8,311
Yakima	28,926	28,944	28,961	29,008	29,056	29,103	29,150	29,197	29,245	29,294	29,342

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:											
	4/17	4/18	4/19	4/20	4/22				4/24				4/26			
Benton	16,206	16,220	16,233	16,281	16,356	(3,271)	[785]	{393}	16,433	(3,287)	[789]	{394}	16,513	(3,303)	[793]	{396}
Clark	21,334	21,394	21,453	21,521	21,683	(4,337)	[1,041]	{520}	21,850	(4,370)	[1,049]	{524}	22,027	(4,405)	[1,057]	{529}
Grant	8,271	8,284	8,297	8,402	8,434	(1,687)	[405]	{202}	8,469	(1,694)	[407]	{203}	8,505	(1,701)	[408]	{204}
Island	1,549	1,552	1,555	1,563	1,576	(315)	[76]	{38}	1,590	(318)	[76]	{38}	1,606	(321)	[77]	{39}
King	96,808	97,019	97,230	97,712	98,481	(19,696)	[4,727]	{2,364}	99,247	(19,849)	[4,764]	{2,382}	100,052	(20,010)	[4,803]	{2,401}
Kitsap	7,054	7,072	7,089	7,150	7,240	(1,448)	[348]	{174}	7,333	(1,467)	[352]	{176}	7,433	(1,487)	[357]	{178}
Pierce	45,950	46,151	46,351	46,602	47,058	(9,412)	[2,259]	{1,129}	47,532	(9,506)	[2,282]	{1,141}	48,018	(9,604)	[2,305]	{1,152}
Skagit	5,048	5,061	5,074	5,103	5,153	(1,031)	[247]	{124}	5,207	(1,041)	[250]	{125}	5,264	(1,053)	[253]	{126}
Snohomish	34,237	34,287	34,337	34,524	34,817	(6,963)	[1,671]	{836}	35,116	(7,023)	[1,686]	{843}	35,437	(7,087)	[1,701]	{850}
Spokane	40,069	40,111	40,153	40,357	40,603	(8,121)	[1,949]	{974}	40,861	(8,172)	[1,961]	{981}	41,136	(8,227)	[1,975]	{987}
Thurston	8,386	8,397	8,407	8,441	8,514	(1,703)	[409]	{204}	8,593	(1,719)	[412]	{206}	8,675	(1,735)	[416]	{208}
Whatcom	8,018	8,015	8,011	8,049	8,120	(1,624)	[390]	{195}	8,193	(1,639)	[393]	{197}	8,270	(1,654)	[397]	{198}
Yakima	28,926	28,944	28,961	29,008	29,103	(5,821)	[1,397]	{698}	29,197	(5,839)	[1,401]	{701}	29,294	(5,859)	[1,406]	{703}

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.