

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

Date: 12/22/21

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 12/22/21 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.

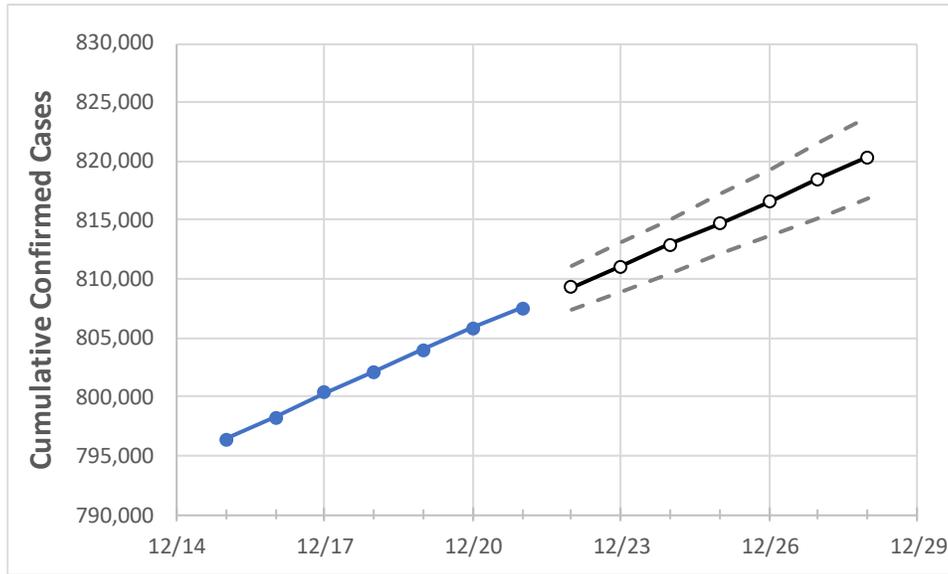
IEM's Modeling Lead

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:							
	12/18	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27	12/28	
Washington	802,163	803,997	805,831	807,529	809,281	811,068	812,886	814,732	816,594	818,490	820,366	

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:							
	12/18	12/19	12/20	12/21	12/22	12/23	12/24	12/25	12/26	12/27	12/28	
Benton	32,794	32,809	32,824	32,859	32,882	32,903	32,925	32,946	32,968	32,989	33,009	
Clark	47,016	47,081	47,145	47,330	47,435	47,542	47,645	47,753	47,865	47,972	48,082	
Grant	17,347	17,361	17,374	17,389	17,406	17,422	17,439	17,455	17,471	17,487	17,503	
Island	4,681	4,695	4,709	4,719	4,731	4,743	4,755	4,767	4,780	4,792	4,804	
King	179,909	180,677	181,446	182,058	182,703	183,361	184,055	184,788	185,524	186,337	187,140	
Kitsap	18,954	18,998	19,042	19,068	19,110	19,152	19,195	19,237	19,280	19,323	19,367	
Pierce	103,006	103,294	103,583	103,831	104,103	104,376	104,660	104,946	105,233	105,531	105,833	
Skagit	13,369	13,399	13,429	13,462	13,490	13,519	13,547	13,575	13,604	13,633	13,661	
Snohomish	75,358	75,561	75,765	75,946	76,121	76,299	76,480	76,663	76,841	77,025	77,207	
Spokane	79,154	79,230	79,305	79,341	79,410	79,477	79,545	79,610	79,674	79,739	79,800	
Thurston	24,079	24,168	24,256	24,337	24,419	24,501	24,587	24,673	24,758	24,847	24,937	
Whatcom	19,328	19,376	19,423	19,465	19,514	19,565	19,613	19,662	19,710	19,761	19,811	
Yakima	46,017	46,037	46,056	46,077	46,106	46,134	46,162	46,190	46,218	46,245	46,271	

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:											
	12/18	12/19	12/20	12/21	12/23			12/25			12/27					
Benton	32,794	32,809	32,824	32,859	32,903	(6,581)	[1,579]	{790}	32,946	(6,589)	[1,581]	{791}	32,989	(6,598)	[1,583]	{792}
Clark	47,016	47,081	47,145	47,330	47,542	(9,508)	[2,282]	{1,141}	47,753	(9,551)	[2,292]	{1,146}	47,972	(9,594)	[2,303]	{1,151}
Grant	17,347	17,361	17,374	17,389	17,422	(3,484)	[836]	{418}	17,455	(3,491)	[838]	{419}	17,487	(3,497)	[839]	{420}
Island	4,681	4,695	4,709	4,719	4,743	(949)	[228]	{114}	4,767	(953)	[229]	{114}	4,792	(958)	[230]	{115}
King	179,909	180,677	181,446	182,058	183,361	(36,672)	[8,801]	{4,401}	184,788	(36,958)	[8,870]	{4,435}	186,337	(37,267)	[8,944]	{4,472}
Kitsap	18,954	18,998	19,042	19,068	19,152	(3,830)	[919]	{460}	19,237	(3,847)	[923]	{462}	19,323	(3,865)	[928]	{464}
Pierce	103,006	103,294	103,583	103,831	104,376	(20,875)	[5,010]	{2,505}	104,946	(20,989)	[5,037]	{2,519}	105,531	(21,106)	[5,065]	{2,533}
Skagit	13,369	13,399	13,429	13,462	13,519	(2,704)	[649]	{324}	13,575	(2,715)	[652]	{326}	13,633	(2,727)	[654]	{327}
Snohomish	75,358	75,561	75,765	75,946	76,299	(15,260)	[3,662]	{1,831}	76,663	(15,333)	[3,680]	{1,840}	77,025	(15,405)	[3,697]	{1,849}
Spokane	79,154	79,230	79,305	79,341	79,477	(15,895)	[3,815]	{1,907}	79,610	(15,922)	[3,821]	{1,911}	79,739	(15,948)	[3,827]	{1,914}
Thurston	24,079	24,168	24,256	24,337	24,501	(4,900)	[1,176]	{588}	24,673	(4,935)	[1,184]	{592}	24,847	(4,969)	[1,193]	{596}
Whatcom	19,328	19,376	19,423	19,465	19,565	(3,913)	[939]	{470}	19,662	(3,932)	[944]	{472}	19,761	(3,952)	[949]	{474}
Yakima	46,017	46,037	46,056	46,077	46,134	(9,227)	[2,214]	{1,107}	46,190	(9,238)	[2,217]	{1,109}	46,245	(9,249)	[2,220]	{1,110}

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.