

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 12/17/21**

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 12/17/21 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.

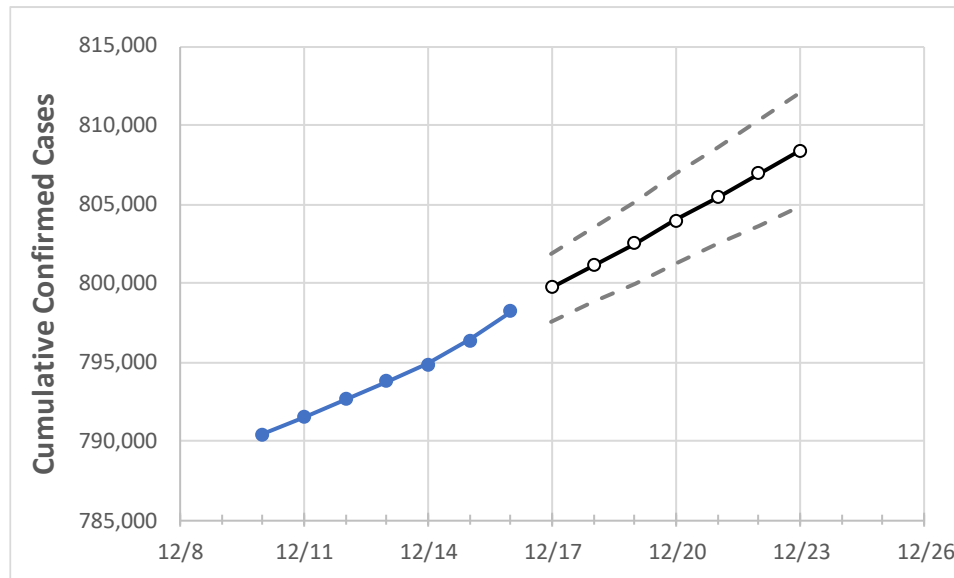
IEM's Modeling Lead

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:						
	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23
Washington	793,757	794,878	796,369	798,239	799,699	801,097	802,539	803,987	805,441	806,925	808,406

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:						
	12/13	12/14	12/15	12/16	12/17	12/18	12/19	12/20	12/21	12/22	12/23
Benton	32,694	32,713	32,735	32,760	32,788	32,815	32,841	32,868	32,895	32,922	32,949
Clark	46,414	46,535	46,673	46,781	46,880	46,979	47,079	47,176	47,275	47,374	47,474
Grant	17,253	17,272	17,299	17,316	17,337	17,359	17,380	17,402	17,423	17,445	17,466
Island	4,627	4,632	4,640	4,653	4,664	4,675	4,686	4,697	4,708	4,719	4,730
King	177,187	177,441	177,812	178,403	178,781	179,167	179,562	179,958	180,383	180,798	181,222
Kitsap	18,728	18,755	18,801	18,844	18,884	18,923	18,963	19,003	19,044	19,084	19,125
Pierce	101,765	101,924	102,157	102,393	102,612	102,829	103,058	103,280	103,505	103,733	103,966
Skagit	13,223	13,245	13,270	13,295	13,319	13,342	13,365	13,387	13,409	13,432	13,453
Snohomish	74,534	74,670	74,795	75,005	75,172	75,335	75,495	75,654	75,820	75,980	76,147
Spokane	78,732	78,812	78,901	78,992	79,074	79,155	79,235	79,314	79,396	79,473	79,549
Thurston	23,690	23,738	23,807	23,900	23,963	24,027	24,091	24,153	24,220	24,284	24,350
Whatcom	19,062	19,113	19,164	19,203	19,255	19,307	19,360	19,412	19,464	19,516	19,569
Yakima	45,842	45,878	45,904	45,946	45,985	46,020	46,058	46,093	46,130	46,167	46,200

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:											
	12/13	12/14	12/15	12/16	12/18				12/20				12/22			
Benton	32,694	32,713	32,735	32,760	32,815	(6,563)	[1,575]	{788}	32,868	(6,574)	[1,578]	{789}	32,922	(6,584)	[1,580]	{790}
Clark	46,414	46,535	46,673	46,781	46,979	(9,396)	[2,255]	{1,127}	47,176	(9,435)	[2,264]	{1,132}	47,374	(9,475)	[2,274]	{1,137}
Grant	17,253	17,272	17,299	17,316	17,359	(3,472)	[833]	{417}	17,402	(3,480)	[835]	{418}	17,445	(3,489)	[837]	{419}
Island	4,627	4,632	4,640	4,653	4,675	(935)	[224]	{112}	4,697	(939)	[225]	{113}	4,719	(944)	[227]	{113}
King	177,187	177,441	177,812	178,403	179,167	(35,833)	[8,600]	{4,300}	179,958	(35,992)	[8,638]	{4,319}	180,798	(36,160)	[8,678]	{4,339}
Kitsap	18,728	18,755	18,801	18,844	18,923	(3,785)	[908]	{454}	19,003	(3,801)	[912]	{456}	19,084	(3,817)	[916]	{458}
Pierce	101,765	101,924	102,157	102,393	102,829	(20,566)	[4,936]	{2,468}	103,280	(20,656)	[4,957]	{2,479}	103,733	(20,747)	[4,979]	{2,490}
Skagit	13,223	13,245	13,270	13,295	13,342	(2,668)	[640]	{320}	13,387	(2,677)	[643]	{321}	13,432	(2,686)	[645]	{322}
Snohomish	74,534	74,670	74,795	75,005	75,335	(15,067)	[3,616]	{1,808}	75,654	(15,131)	[3,631]	{1,816}	75,980	(15,196)	[3,647]	{1,824}
Spokane	78,732	78,812	78,901	78,992	79,155	(15,831)	[3,799]	{1,900}	79,314	(15,863)	[3,807]	{1,904}	79,473	(15,895)	[3,815]	{1,907}
Thurston	23,690	23,738	23,807	23,900	24,027	(4,805)	[1,153]	{577}	24,153	(4,831)	[1,159]	{580}	24,284	(4,857)	[1,166]	{583}
Whatcom	19,062	19,113	19,164	19,203	19,307	(3,861)	[927]	{463}	19,412	(3,882)	[932]	{466}	19,516	(3,903)	[937]	{468}
Yakima	45,842	45,878	45,904	45,946	46,020	(9,204)	[2,209]	{1,104}	46,093	(9,219)	[2,212]	{1,106}	46,167	(9,233)	[2,216]	{1,108}

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.