

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

Date: 1/15/21

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 1/15/21 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.

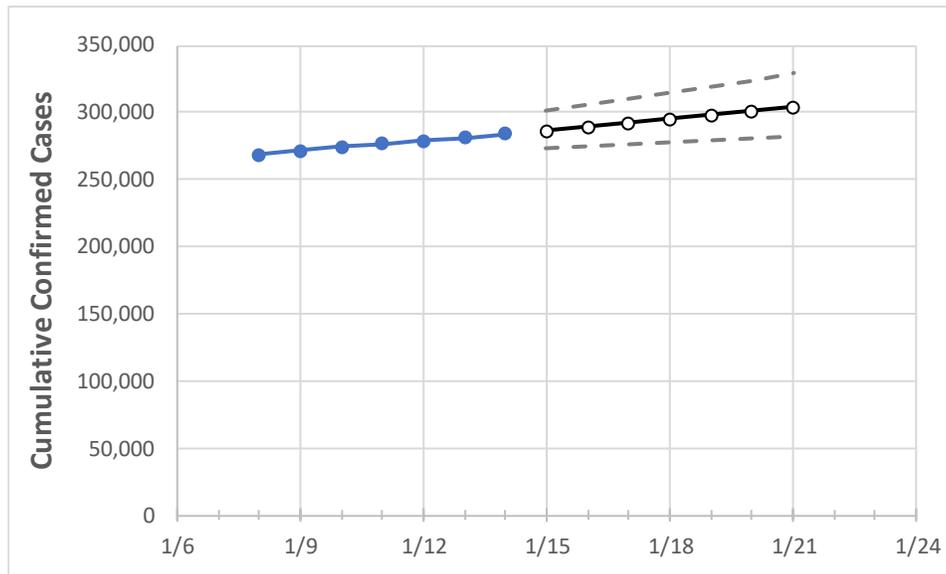
IEM's Modeling Lead

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:						
	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19	1/20	1/21
Washington	276,686	278,544	281,202	283,777	286,513	289,336	292,142	295,012	297,900	300,861	303,987

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:						
	1/11	1/12	1/13	1/14	1/15	1/16	1/17	1/18	1/19	1/20	1/21
Benton	12,908	12,982	13,111	13,216	13,334	13,454	13,574	13,698	13,823	13,951	14,081
Clark	15,301	15,590	15,617	15,734	15,909	16,095	16,279	16,466	16,652	16,849	17,042
Grant	6,445	6,473	6,531	6,595	6,641	6,688	6,736	6,785	6,834	6,884	6,937
Island	1,042	1,058	1,067	1,070	1,082	1,094	1,106	1,118	1,130	1,143	1,155
King	70,059	70,545	71,106	71,646	72,326	73,015	73,720	74,433	75,156	75,874	76,628
Kitsap	4,450	4,490	4,516	4,595	4,652	4,710	4,770	4,831	4,895	4,959	5,022
Pierce	29,205	29,563	30,008	30,193	30,535	30,884	31,238	31,617	32,001	32,370	32,764
Skagit	3,610	3,623	3,719	3,750	3,784	3,818	3,854	3,891	3,928	3,965	4,002
Snohomish	25,186	25,243	25,468	25,698	25,936	26,167	26,411	26,663	26,913	27,165	27,413
Spokane	29,176	29,332	29,678	30,070	30,462	30,851	31,254	31,687	32,106	32,536	32,986
Thurston	5,440	5,463	5,528	5,627	5,694	5,762	5,833	5,904	5,977	6,052	6,127
Whatcom	4,373	4,357	4,465	4,594	4,720	4,849	4,994	5,142	5,301	5,477	5,661
Yakima	22,005	22,148	22,311	22,529	22,725	22,919	23,119	23,313	23,510	23,714	23,907

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:											
	1/11	1/12	1/13	1/14	1/16			1/18			1/20					
Benton	12,908	12,982	13,111	13,216	13,454	(2,691)	[646]	{323}	13,698	(2,740)	[658]	{329}	13,951	(2,790)	[670]	{335}
Clark	15,301	15,590	15,617	15,734	16,095	(3,219)	[773]	{386}	16,466	(3,293)	[790]	{395}	16,849	(3,370)	[809]	{404}
Grant	6,445	6,473	6,531	6,595	6,688	(1,338)	[321]	{161}	6,785	(1,357)	[326]	{163}	6,884	(1,377)	[330]	{165}
Island	1,042	1,058	1,067	1,070	1,094	(219)	[52]	{26}	1,118	(224)	[54]	{27}	1,143	(229)	[55]	{27}
King	70,059	70,545	71,106	71,646	73,015	(14,603)	[3,505]	{1,752}	74,433	(14,887)	[3,573]	{1,786}	75,874	(15,175)	[3,642]	{1,821}
Kitsap	4,450	4,490	4,516	4,595	4,710	(942)	[226]	{113}	4,831	(966)	[232]	{116}	4,959	(992)	[238]	{119}
Pierce	29,205	29,563	30,008	30,193	30,884	(6,177)	[1,482]	{741}	31,617	(6,323)	[1,518]	{759}	32,370	(6,474)	[1,554]	{777}
Skagit	3,610	3,623	3,719	3,750	3,818	(764)	[183]	{92}	3,891	(778)	[187]	{93}	3,965	(793)	[190]	{95}
Snohomish	25,186	25,243	25,468	25,698	26,167	(5,233)	[1,256]	{628}	26,663	(5,333)	[1,280]	{640}	27,165	(5,433)	[1,304]	{652}
Spokane	29,176	29,332	29,678	30,070	30,851	(6,170)	[1,481]	{740}	31,687	(6,337)	[1,521]	{760}	32,536	(6,507)	[1,562]	{781}
Thurston	5,440	5,463	5,528	5,627	5,762	(1,152)	[277]	{138}	5,904	(1,181)	[283]	{142}	6,052	(1,210)	[290]	{145}
Whatcom	4,373	4,357	4,465	4,594	4,849	(970)	[233]	{116}	5,142	(1,028)	[247]	{123}	5,477	(1,095)	[263]	{131}
Yakima	22,005	22,148	22,311	22,529	22,919	(4,584)	[1,100]	{550}	23,313	(4,663)	[1,119]	{560}	23,714	(4,743)	[1,138]	{569}

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.