

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

Date: 1/28/22

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 1/28/22 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.

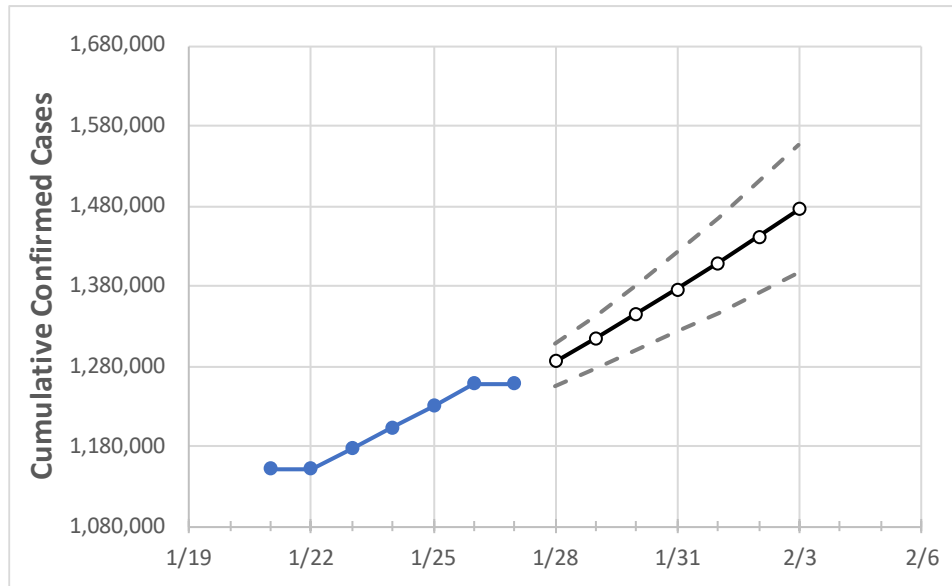
IEM's Modeling Lead

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:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3
Washington	1,203,311	1,230,615	1,257,918	1,257,918	1,286,024	1,315,491	1,345,238	1,376,400	1,408,671	1,442,042	1,475,874

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:						
	1/24	1/25	1/26	1/27	1/28	1/29	1/30	1/31	2/1	2/2	2/3
Benton	42,667	43,831	44,995	44,995	45,927	46,886	47,883	48,922	50,004	51,153	52,316
Clark	68,607	69,914	71,220	71,220	72,931	74,698	76,453	78,321	80,154	82,138	84,055
Grant	21,667	22,048	22,429	22,429	22,784	23,163	23,546	23,949	24,355	24,791	25,243
Island	7,863	8,055	8,247	8,247	8,417	8,589	8,763	8,939	9,123	9,306	9,496
King	313,773	318,647	323,520	323,520	328,077	332,616	337,089	341,600	346,060	350,501	354,987
Kitsap	31,186	32,325	33,464	33,464	34,253	35,073	35,910	36,759	37,636	38,537	39,448
Pierce	160,388	163,881	167,374	167,374	170,126	172,909	175,705	178,596	181,476	184,496	187,382
Skagit	19,009	19,226	19,443	19,443	19,679	19,919	20,156	20,397	20,642	20,896	21,128
Snohomish	121,499	126,043	130,586	130,586	133,030	135,553	138,117	140,751	143,474	146,237	148,923
Spokane	102,831	105,428	108,024	108,024	110,121	112,294	114,529	116,873	119,312	121,922	124,507
Thurston	39,351	39,919	40,487	40,487	41,108	41,741	42,369	43,008	43,653	44,302	44,954
Whatcom	30,202	30,805	31,408	31,408	31,946	32,484	33,036	33,595	34,157	34,722	35,305
Yakima	59,560	61,123	62,685	62,685	64,125	65,638	67,219	68,862	70,589	72,383	74,270

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:											
	1/24	1/25	1/26	1/27	1/29				1/31				2/2			
Benton	42,667	43,831	44,995	44,995	46,886	(9,377)	[2,251]	{1,125}	48,922	(9,784)	[2,348]	{1,174}	51,153	(10,231)	[2,455]	{1,228}
Clark	68,607	69,914	71,220	71,220	74,698	(14,940)	[3,585]	{1,793}	78,321	(15,664)	[3,759]	{1,880}	82,138	(16,428)	[3,943]	{1,971}
Grant	21,667	22,048	22,429	22,429	23,163	(4,633)	[1,112]	{556}	23,949	(4,790)	[1,150]	{575}	24,791	(4,958)	[1,190]	{595}
Island	7,863	8,055	8,247	8,247	8,589	(1,718)	[412]	{206}	8,939	(1,788)	[429]	{215}	9,306	(1,861)	[447]	{223}
King	313,773	318,647	323,520	323,520	332,616	(66,523)	[15,966]	{7,983}	341,600	(68,320)	[16,397]	{8,198}	350,501	(70,100)	[16,824]	{8,412}
Kitsap	31,186	32,325	33,464	33,464	35,073	(7,015)	[1,684]	{842}	36,759	(7,352)	[1,764]	{882}	38,537	(7,707)	[1,850]	{925}
Pierce	160,388	163,881	167,374	167,374	172,909	(34,582)	[8,300]	{4,150}	178,596	(35,719)	[8,573]	{4,286}	184,496	(36,899)	[8,856]	{4,428}
Skagit	19,009	19,226	19,443	19,443	19,919	(3,984)	[956]	{478}	20,397	(4,079)	[979]	{490}	20,896	(4,179)	[1,003]	{502}
Snohomish	121,499	126,043	130,586	130,586	135,553	(27,111)	[6,507]	{3,253}	140,751	(28,150)	[6,756]	{3,378}	146,237	(29,247)	[7,019]	{3,510}
Spokane	102,831	105,428	108,024	108,024	112,294	(22,459)	[5,390]	{2,695}	116,873	(23,375)	[5,610]	{2,805}	121,922	(24,384)	[5,852]	{2,926}
Thurston	39,351	39,919	40,487	40,487	41,741	(8,348)	[2,004]	{1,002}	43,008	(8,602)	[2,064]	{1,032}	44,302	(8,860)	[2,127]	{1,063}
Whatcom	30,202	30,805	31,408	31,408	32,484	(6,497)	[1,559]	{780}	33,595	(6,719)	[1,613]	{806}	34,722	(6,944)	[1,667]	{833}
Yakima	59,560	61,123	62,685	62,685	65,638	(13,128)	[3,151]	{1,575}	68,862	(13,772)	[3,305]	{1,653}	72,383	(14,477)	[3,474]	{1,737}

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.