

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

Date: 3/30/21

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 3/30/21 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.

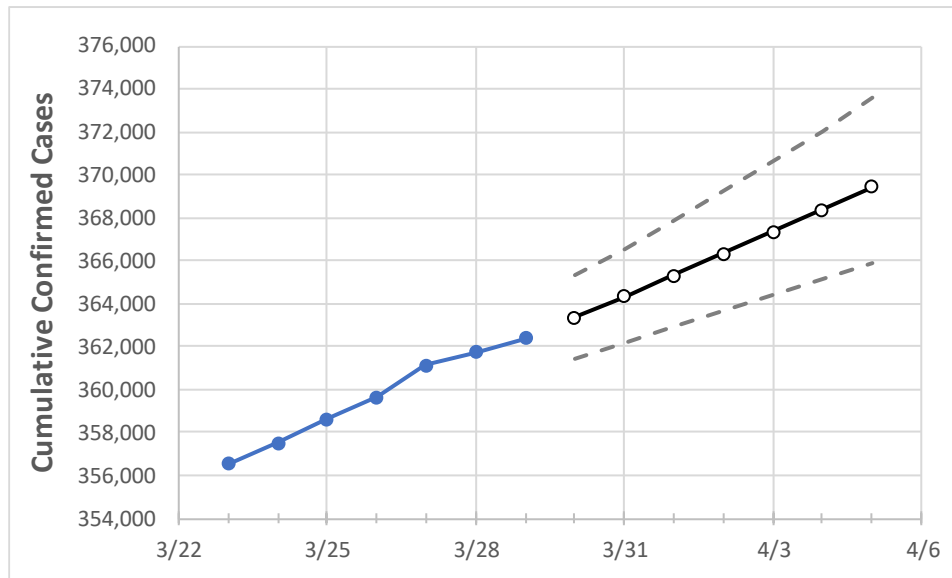
IEM's Modeling Lead

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:					
	3/26	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5
Washington	359,666	361,115	361,750	362,385	363,342	364,322	365,307	366,318	367,360	368,384	369,445

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:						
	3/26	3/27	3/28	3/29	3/30	3/31	4/1	4/2	4/3	4/4	4/5
Benton	15,568	15,606	15,618	15,629	15,650	15,670	15,691	15,711	15,732	15,753	15,773
Clark	19,949	20,026	20,066	20,105	20,155	20,204	20,254	20,305	20,356	20,409	20,462
Grant	7,989	8,007	8,014	8,020	8,031	8,041	8,052	8,063	8,073	8,083	8,094
Island	1,462	1,464	1,466	1,468	1,470	1,472	1,474	1,476	1,477	1,479	1,480
King	89,203	89,636	89,881	90,125	90,465	90,821	91,187	91,572	91,972	92,382	92,811
Kitsap	6,248	6,283	6,310	6,336	6,360	6,384	6,408	6,432	6,457	6,483	6,509
Pierce	41,684	41,934	42,063	42,192	42,365	42,543	42,723	42,906	43,091	43,281	43,478
Skagit	4,697	4,707	4,712	4,716	4,723	4,730	4,736	4,743	4,750	4,756	4,763
Snohomish	31,657	31,765	31,825	31,884	31,963	32,045	32,129	32,215	32,302	32,394	32,488
Spokane	38,019	38,139	38,196	38,252	38,320	38,390	38,463	38,535	38,606	38,679	38,755
Thurston	7,714	7,758	7,766	7,774	7,797	7,819	7,842	7,864	7,888	7,911	7,935
Whatcom	7,417	7,447	7,465	7,483	7,506	7,528	7,550	7,571	7,593	7,615	7,637
Yakima	27,785	27,868	27,891	27,914	27,950	27,987	28,023	28,060	28,097	28,132	28,167

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:											
	3/26	3/27	3/28	3/29	3/31				4/2				4/4			
Benton	15,568	15,606	15,618	15,629	15,670	(3,134)	[752]	{376}	15,711	(3,142)	[754]	{377}	15,753	(3,151)	[756]	{378}
Clark	19,949	20,026	20,066	20,105	20,204	(4,041)	[970]	{485}	20,305	(4,061)	[975]	{487}	20,409	(4,082)	[980]	{490}
Grant	7,989	8,007	8,014	8,020	8,041	(1,608)	[386]	{193}	8,063	(1,613)	[387]	{194}	8,083	(1,617)	[388]	{194}
Island	1,462	1,464	1,466	1,468	1,472	(294)	[71]	{35}	1,476	(295)	[71]	{35}	1,479	(296)	[71]	{35}
King	89,203	89,636	89,881	90,125	90,821	(18,164)	[4,359]	{2,180}	91,572	(18,314)	[4,395]	{2,198}	92,382	(18,476)	[4,434]	{2,217}
Kitsap	6,248	6,283	6,310	6,336	6,384	(1,277)	[306]	{153}	6,432	(1,286)	[309]	{154}	6,483	(1,297)	[311]	{156}
Pierce	41,684	41,934	42,063	42,192	42,543	(8,509)	[2,042]	{1,021}	42,906	(8,581)	[2,059]	{1,030}	43,281	(8,656)	[2,077]	{1,039}
Skagit	4,697	4,707	4,712	4,716	4,730	(946)	[227]	{114}	4,743	(949)	[228]	{114}	4,756	(951)	[228]	{114}
Snohomish	31,657	31,765	31,825	31,884	32,045	(6,409)	[1,538]	{769}	32,215	(6,443)	[1,546]	{773}	32,394	(6,479)	[1,555]	{777}
Spokane	38,019	38,139	38,196	38,252	38,390	(7,678)	[1,843]	{921}	38,535	(7,707)	[1,850]	{925}	38,679	(7,736)	[1,857]	{928}
Thurston	7,714	7,758	7,766	7,774	7,819	(1,564)	[375]	{188}	7,864	(1,573)	[377]	{189}	7,911	(1,582)	[380]	{190}
Whatcom	7,417	7,447	7,465	7,483	7,528	(1,506)	[361]	{181}	7,571	(1,514)	[363]	{182}	7,615	(1,523)	[366]	{183}
Yakima	27,785	27,868	27,891	27,914	27,987	(5,597)	[1,343]	{672}	28,060	(5,612)	[1,347]	{673}	28,132	(5,626)	[1,350]	{675}

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.