

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

Date: 3/23/21

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 3/23/21 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.

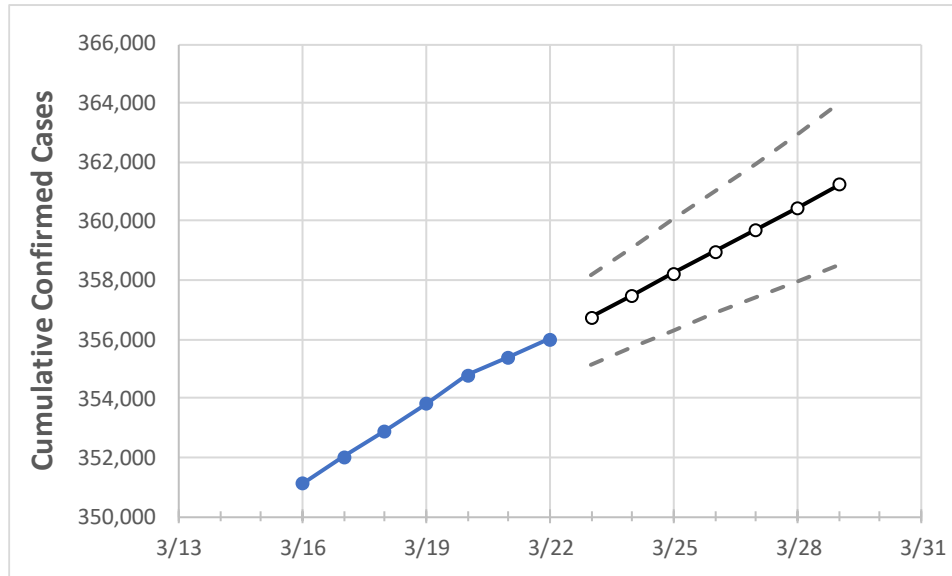
IEM's Modeling Lead

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:						
	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29
Washington	353,792	354,782	355,384	355,986	356,725	357,473	358,216	358,956	359,713	360,469	361,216

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:						
	3/19	3/20	3/21	3/22	3/23	3/24	3/25	3/26	3/27	3/28	3/29
Benton	15,427	15,455	15,472	15,488	15,508	15,528	15,548	15,568	15,587	15,607	15,627
Clark	19,640	19,710	19,739	19,768	19,810	19,854	19,897	19,941	19,985	20,029	20,074
Grant	7,912	7,928	7,938	7,948	7,961	7,973	7,986	7,999	8,011	8,023	8,036
Island	1,440	1,445	1,448	1,450	1,454	1,457	1,461	1,464	1,467	1,470	1,473
King	87,393	87,626	87,824	88,021	88,242	88,463	88,692	88,924	89,162	89,400	89,647
Kitsap	6,125	6,148	6,161	6,174	6,196	6,218	6,241	6,264	6,288	6,311	6,336
Pierce	40,626	40,819	40,954	41,089	41,234	41,380	41,527	41,679	41,831	41,983	42,139
Skagit	4,635	4,644	4,651	4,658	4,664	4,669	4,674	4,679	4,683	4,687	4,691
Snohomish	31,193	31,258	31,312	31,365	31,414	31,462	31,510	31,557	31,606	31,654	31,701
Spokane	37,573	37,663	37,704	37,745	37,799	37,852	37,906	37,960	38,013	38,064	38,114
Thurston	7,543	7,567	7,584	7,600	7,615	7,630	7,644	7,659	7,673	7,688	7,702
Whatcom	7,261	7,278	7,291	7,303	7,320	7,337	7,353	7,369	7,384	7,399	7,414
Yakima	27,546	27,576	27,597	27,617	27,651	27,683	27,713	27,745	27,776	27,806	27,835

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:											
	3/19	3/20	3/21	3/22	3/24			3/26			3/28					
Benton	15,427	15,455	15,472	15,488	15,528	(3,106)	[745]	{373}	15,568	(3,114)	[747]	{374}	15,607	(3,121)	[749]	{375}
Clark	19,640	19,710	19,739	19,768	19,854	(3,971)	[953]	{476}	19,941	(3,988)	[957]	{479}	20,029	(4,006)	[961]	{481}
Grant	7,912	7,928	7,938	7,948	7,973	(1,595)	[383]	{191}	7,999	(1,600)	[384]	{192}	8,023	(1,605)	[385]	{193}
Island	1,440	1,445	1,448	1,450	1,457	(291)	[70]	{35}	1,464	(293)	[70]	{35}	1,470	(294)	[71]	{35}
King	87,393	87,626	87,824	88,021	88,463	(17,693)	[4,246]	{2,123}	88,924	(17,785)	[4,268]	{2,134}	89,400	(17,880)	[4,291]	{2,146}
Kitsap	6,125	6,148	6,161	6,174	6,218	(1,244)	[298]	{149}	6,264	(1,253)	[301]	{150}	6,311	(1,262)	[303]	{151}
Pierce	40,626	40,819	40,954	41,089	41,380	(8,276)	[1,986]	{993}	41,679	(8,336)	[2,001]	{1,000}	41,983	(8,397)	[2,015]	{1,008}
Skagit	4,635	4,644	4,651	4,658	4,669	(934)	[224]	{112}	4,679	(936)	[225]	{112}	4,687	(937)	[225]	{112}
Snohomish	31,193	31,258	31,312	31,365	31,462	(6,292)	[1,510]	{755}	31,557	(6,311)	[1,515]	{757}	31,654	(6,331)	[1,519]	{760}
Spokane	37,573	37,663	37,704	37,745	37,852	(7,570)	[1,817]	{908}	37,960	(7,592)	[1,822]	{911}	38,064	(7,613)	[1,827]	{914}
Thurston	7,543	7,567	7,584	7,600	7,630	(1,526)	[366]	{183}	7,659	(1,532)	[368]	{184}	7,688	(1,538)	[369]	{185}
Whatcom	7,261	7,278	7,291	7,303	7,337	(1,467)	[352]	{176}	7,369	(1,474)	[354]	{177}	7,399	(1,480)	[355]	{178}
Yakima	27,546	27,576	27,597	27,617	27,683	(5,537)	[1,329]	{664}	27,745	(5,549)	[1,332]	{666}	27,806	(5,561)	[1,335]	{667}

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.