

IEM's AI Modeling: Short-term COVID-19 Projections**Date: 2/22/21**

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 2/22/21 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.

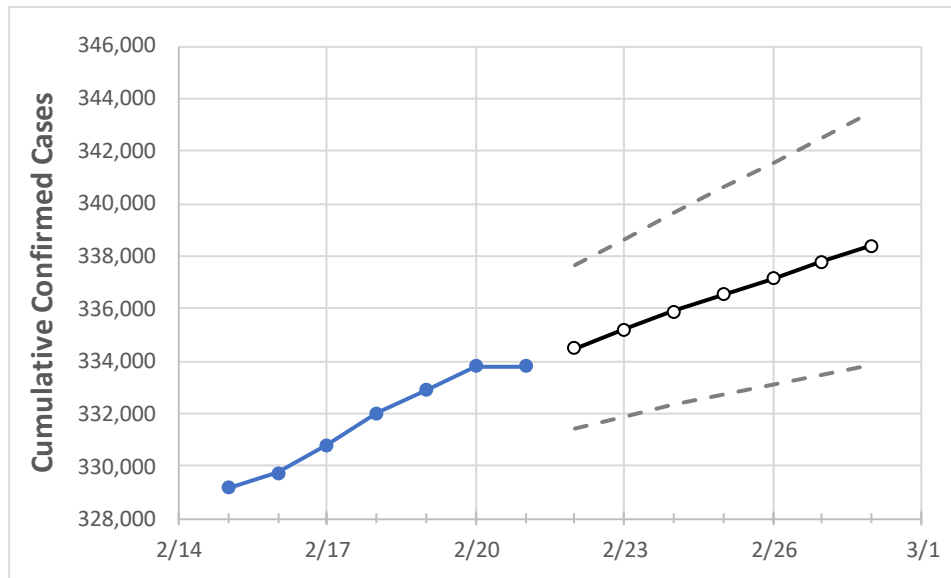
IEM's Modeling Lead

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:							
	2/18	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	
Washington	332,007	332,904	333,794	333,794	334,496	335,194	335,869	336,526	337,159	337,774	338,376	

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:							
	2/18	2/19	2/20	2/21	2/22	2/23	2/24	2/25	2/26	2/27	2/28	
Benton	14,774	14,793	14,830	14,830	14,853	14,875	14,896	14,917	14,936	14,956	14,973	
Clark	18,516	18,551	18,612	18,612	18,644	18,676	18,704	18,734	18,761	18,788	18,814	
Grant	7,513	7,540	7,556	7,556	7,572	7,587	7,601	7,616	7,630	7,644	7,658	
Island	1,271	1,272	1,274	1,274	1,276	1,278	1,280	1,282	1,284	1,286	1,287	
King	82,402	82,615	82,835	82,835	82,998	83,158	83,314	83,467	83,617	83,759	83,896	
Kitsap	5,606	5,632	5,647	5,647	5,662	5,676	5,689	5,702	5,715	5,728	5,739	
Pierce	37,039	37,152	37,243	37,243	37,368	37,490	37,607	37,722	37,832	37,939	38,047	
Skagit	4,320	4,323	4,341	4,341	4,349	4,356	4,363	4,370	4,377	4,383	4,389	
Snohomish	29,506	29,595	29,705	29,705	29,787	29,867	29,950	30,030	30,106	30,182	30,257	
Spokane	35,579	35,677	35,780	35,780	35,854	35,927	35,998	36,065	36,132	36,192	36,257	
Thurston	6,964	6,980	7,024	7,024	7,056	7,088	7,120	7,152	7,184	7,216	7,249	
Whatcom	6,399	6,439	6,456	6,456	6,491	6,526	6,559	6,592	6,622	6,651	6,679	
Yakima	26,107	26,150	26,198	26,198	26,233	26,267	26,298	26,329	26,358	26,384	26,411	

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:											
	2/18	2/19	2/20	2/21	2/23				2/25				2/27			
Benton	14,774	14,793	14,830	14,830	14,875	(2,975)	[714]	{357}	14,917	(2,983)	[716]	{358}	14,956	(2,991)	[718]	{359}
Clark	18,516	18,551	18,612	18,612	18,676	(3,735)	[896]	{448}	18,734	(3,747)	[899]	{450}	18,788	(3,758)	[902]	{451}
Grant	7,513	7,540	7,556	7,556	7,587	(1,517)	[364]	{182}	7,616	(1,523)	[366]	{183}	7,644	(1,529)	[367]	{183}
Island	1,271	1,272	1,274	1,274	1,278	(256)	[61]	{31}	1,282	(256)	[62]	{31}	1,286	(257)	[62]	{31}
King	82,402	82,615	82,835	82,835	83,158	(16,632)	[3,992]	{1,996}	83,467	(16,693)	[4,006]	{2,003}	83,759	(16,752)	[4,020]	{2,010}
Kitsap	5,606	5,632	5,647	5,647	5,676	(1,135)	[272]	{136}	5,702	(1,140)	[274]	{137}	5,728	(1,146)	[275]	{137}
Pierce	37,039	37,152	37,243	37,243	37,490	(7,498)	[1,800]	{900}	37,722	(7,544)	[1,811]	{905}	37,939	(7,588)	[1,821]	{911}
Skagit	4,320	4,323	4,341	4,341	4,356	(871)	[209]	{105}	4,370	(874)	[210]	{105}	4,383	(877)	[210]	{105}
Snohomish	29,506	29,595	29,705	29,705	29,867	(5,973)	[1,434]	{717}	30,030	(6,006)	[1,441]	{721}	30,182	(6,036)	[1,449]	{724}
Spokane	35,579	35,677	35,780	35,780	35,927	(7,185)	[1,725]	{862}	36,065	(7,213)	[1,731]	{866}	36,192	(7,238)	[1,737]	{869}
Thurston	6,964	6,980	7,024	7,024	7,088	(1,418)	[340]	{170}	7,152	(1,430)	[343]	{172}	7,216	(1,443)	[346]	{173}
Whatcom	6,399	6,439	6,456	6,456	6,526	(1,305)	[313]	{157}	6,592	(1,318)	[316]	{158}	6,651	(1,330)	[319]	{160}
Yakima	26,107	26,150	26,198	26,198	26,267	(5,253)	[1,261]	{630}	26,329	(5,266)	[1,264]	{632}	26,384	(5,277)	[1,266]	{633}

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.